HEATING & VENTILATING

For Engineers and Contractors Controlling the Design, Specification, Installation and Maintenance of Heating, Ventilating and Air Conditioning

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CONTENTS

Economy of Unique Control System Demonstrated at Mt. Holyoke College Plant		27
City Smoke and Its Effects		30
How Much Outside Air Is Necessary for Ventilation?		31
Electric Boiler Cuts Heating Costs		35
A Psychrometric Chart with Barometric Pressure as a Variable		36
Heat from the Sun		39
Marked Progress in Equipment Design Displayed at Chicago Show		40
Integrating an Industry		42
Report of 42nd Annual Meeting of ASHVE		44
Picture Paragraphs		46
Purdue Tackles the Housing Problem		48
Warm Air Group Meets in Chicago, Hears Technical Papers		50
Automatic Controls for Winter Central Fan Systems		51
Selective Air Conditioning Provided for Hotel		54
Getting Down to Fundamentals — 10		55
Editorials		59
What Readers Say		60
Abstracts		62
Reference Data, 73 and 74	Opposite	62
News of the Month		63
With the Manufacturers		68
New Equipment		69
Degree-Days for January, 1936		72
The Weather for January, 1936		74
New Catalogs		76

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Centralized Heating Economy

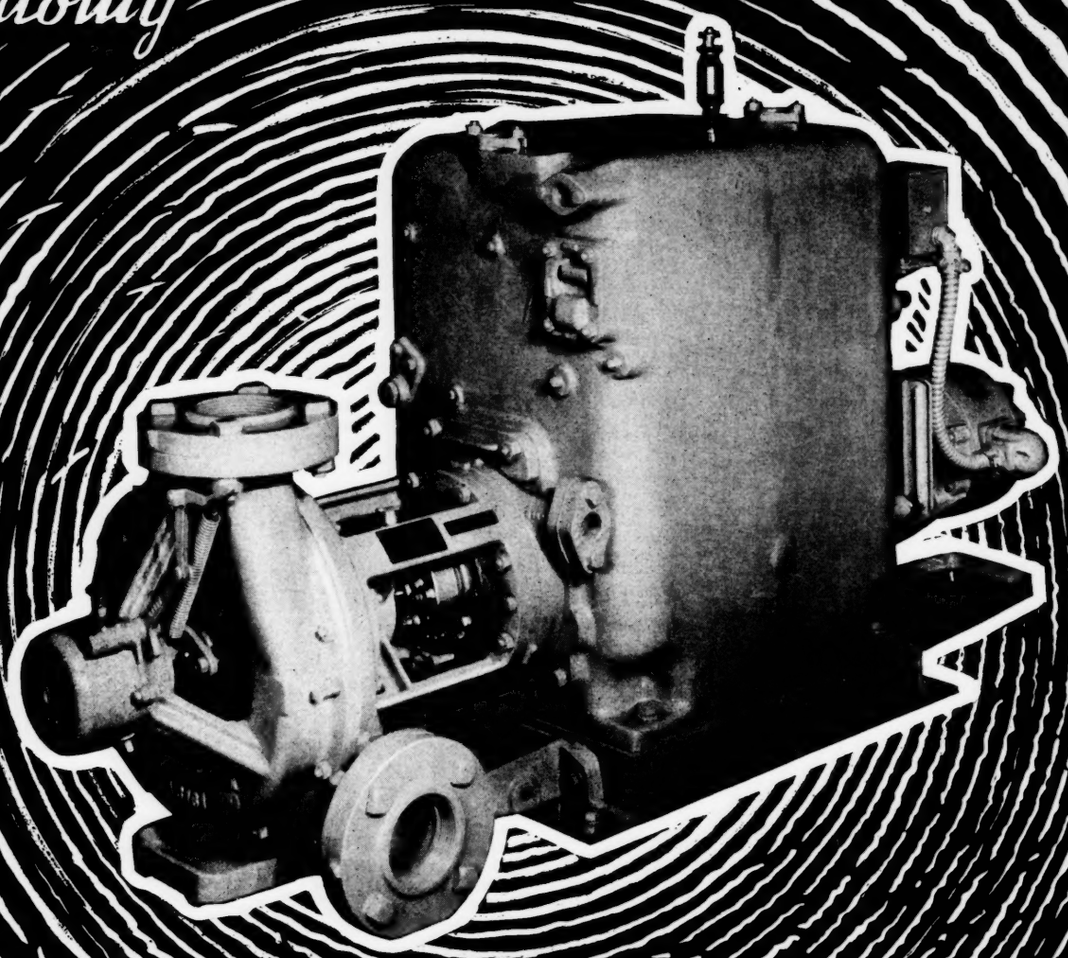

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Fig. 1. Campus of Mount Holyoke College, South Hadley, Mass.

Economy of Unique Control System Demonstrated at Mt. Holyoke College Plant

IN the spring of 1934 the authorities of Mount Holyoke College authorized an extensive modernization of steam generating† and steam using facilities throughout the college buildings. The installation was completed during the summer of 1934 and the heating season of 1934-35 served as a period for adjustment and test operation. An item of major importance in this program was the application of a system providing central control of the heating in some 32 existing buildings of various age and equipment, all supplied with steam from a new central steam generating plant. These buildings included many one-pipe systems, some two-pipe, and two hot water installations. The problem of control application was unusual and the solutions adopted and effectively proven during the past heating season will be of wide general interest.

†See HEATING & VENTILATING, November, 1934, pages 22 and 23.

When the heating plant at Mt. Holyoke College was revamped in 1934 the innovations aroused much interest, caused much comment, and resulted in its being inspected by several hundred engineers, superintendents, and other interested experts.

In this article full details concerning the operating controls are made available for the first time. Early operating results, obtained during February, 1935, demonstrated that substantial savings can be realized.— Editor.

The control engineers' problem had as its starting point a supply of steam in the campus mains maintained at 11 lb. per sq. in. pressure in mild weather down to 8 lb. per sq. in. during periods of maximum heat requirements and extended to effective delivery of steam to all radiators under all degrees of outdoor temperature from 70° down to minimum temperatures requiring that all radiators be completely filled with steam.

The basic type of control employed was what is known as the Webster Moderator Control, utilizing two identical outdoor thermostats to establish a basic rate of steam delivery depending on the outdoor temperature. Variation in rate of steam flow is provided by means of "pulsating flow" control valves.

Zoning was resorted to in order to provide: (a) separate zone control for buildings having different occupancy requirements either as to

time or temperature, or both; (b) a diversification of load so as to avoid unusual peaks or valleys in demand on the boiler plant; (c) to provide for variations in building type and construction.

Supplementing the automatic control provided by the outdoor thermostats, and in the opinion of the engineers one of the most important features of the entire design, is the provision at a central control point of manual devices including: (a) lights to indicate functioning of electric control valves; (b) lights and call bells, to indicate accumulation of water above a maximum level in selected key radiators in each one-pipe zone controlled; (c) switches to permit the remote shutoff of steam delivery to either radiation and piping or both for each zone independent of other zones; (d) a "Variator" to permit increase or decrease of steam delivery to any zone by comparison with the delivery called for by the outdoor thermostat.

The provision of this complete, central control equipment eliminates continuous "cruising" of the campus by the operating force, an expensive and somewhat cumbersome procedure resorted to in connection with many large institutional groups heated from a central plant. The central control further permits the establishment and observance of a definite operating schedule for each building or zone. Provision is made for mounting an operating chart beneath the manual variator control for each zone. This chart can be revised each year as classroom schedules are made up, thereby permitting the operators to take full advantage of the economy gained by shutting off steam whenever a building or zone is unoccupied.

Mechanical and Electrical Equipment

The central control system employs the "pulsating flow" principle. During the cycle of operation, which is approximately 15 min. at Mount Holyoke, each control valve will (a) open, (b) remain open, with a predetermined pressure maintained in the heating system, (c) close, (d) remain closed. Steam delivery to the radiators is controlled by varying the relative length of the "on" and "off" intervals.

The outdoor thermostat automatically determines the length of time during which the control valve is opened and closed. The thermostatic element is a bimetallic coil which expands with increases in temperature and contracts as the temperature falls. This expansion and contraction moves a roller arm over silver contacts, each contact forming a separate electrical circuit opening or closing the electrical circuits to operate the main control valves.

The two outdoor thermostats used at Mount Holyoke are placed behind louvers near the top of a ventilating stack at the central heating plant.

The variator provides a means of modifying by hand the selection of circuit made by the outdoor thermostat. When the variator is set at the "normal" position the circuit selected by the outdoor thermostat determines the operation of the main valve. When the variator is adjusted for less heat or more heat different circuits are selected and the setting of the outdoor thermostat is thus modified.

The variators at Mount Holyoke College are located at the central heating plant and arranged in a panel as shown in Fig. 2. At the top of each variator there is a toggle switch which enables the operator to open or close the main control valve serving the individual building. There is also an additional toggle switch for each bypass valve serving the buildings where this type of valve is required. Lights indicate when the electrical circuits to the main control valves are completed.

The control valves at Mount Holyoke incorporate two functions: (1) a pressure reducing valve to effect final reduction and assure delivery of steam into the heating mains at a predetermined pressure difference, and (2) a remotely controlled, quick-closing shutoff valve to accomplish the "pulsating flow" cycle.

The majority of valves are semi-balanced, double-seated type of conventional design actuated through a lever by a motor-operated hydraulic mechanism. When the control equipment calls for a pulsation of steam, the electrical circuit is closed. The desired pressure difference is held in the steam mains by a spring loaded bellows regulator. Hydraulic operation was selected for this type of valve because it results in smooth, powerful movement without shock or noise and, of greater importance, holds delivery pressures within 1/10 lb. per sq. in., regardless of fluctuating pressures ahead of the valve. A few of the smaller size main control valves are of the diaphragm type opened and closed by a motor directly through a mechanical cam.

A motorized shutoff valve is placed in a small bypass around each main control valve.

The major portion of the orifices used to balance steam distribution in the various buildings consists of a monel metal disc, fixed to a thin phosphor bronze skirt and inserted in the union connection of the supply valve. A few radiators had no union connections at the supply end and here a brass pipe nipple was furnished with the orifice in one end.

The orificing and application of the control equipment to the buildings equipped with one-pipe systems presented a number of interesting problems. Water condensed in the radiator flows back into the mains or return piping during the "off" interval of the main control valve. In order to assure quick and positive drainage during the "off" period as well as the desired steam delivery during the "on" interval radiators must be fully and freely vented. Special air valves with large venting ports are installed at each radiator to accomplish proper venting.

Each one-pipe system is equipped with a standby control valve for use should the regular valve become inoperative. These standby valves are connected through separate wires to separate central control equipment at the central heating plant. This standby equipment also operates on the pulsating flow principle but the off-and-on periods of the control valves are determined entirely by manual adjustment. The standby control panel (with four adjusting knobs) is shown at the extreme left of Fig. 2.

In addition a special float switch mechanism is installed in each one-pipe zone on a selected radiator. Should water build up unduly in the radiator the float will rise, make contact with a switch and a warning

bell is sounded at the control panel in the central heating plant. A light on the variator shows which building is affected. The operator thus knows that the regulator equipment is not functioning properly and shifts over to the standby control during the period of investigation and repair.

Engineering Problems in the Installation

Some of the engineering problems encountered in the application of this unusual central control installation can best be appreciated by considering the installation building by building.

Rockefeller, Porter, Safford, Brigham, Mead and Wilder are dormitory buildings heated similarly by one-pipe systems fed by basement supply mains that split into one or two circuits around the outer wall of the building. Drips are handled by pressure wet returns, in many places located beneath the floor. These discharge through water line traps into the campus return mains. Drip lines are sealed with water at all times to prevent water hammer noises.

Each radiator in these dormitories is fitted with an orifice and a special free venting air valve with a large port. One radiator in each building is fitted with a float switch mechanism wired to a light at the central panel to indicate to the operator the proper drainage of water from the radiators.

Steam flow into the heating system of each building is controlled by one control valve of the "pulsating flow" type operated through a relay by the central control. Initial heating of the cold piping system is provided for by a small size bypass fitted with a motorized shutoff valve operated through a relay from the central control. Each building has one "standby" control valve of the pulsating flow type also operated through a relay and installed in a bypass around the main control valve to serve in the event of difficulty with the primary control system.

Some of the indirect cast iron radiators originally installed were replaced by standing cast iron radiators in order to reduce heat losses from excessive ventilation.

Heating schedules provide for increased temperatures in these dormitories before and during breakfast, at lunch time, and from 4 p.m. to about 7 p.m.

Classroom Buildings

Clapp Hall, the largest building on the campus, contains about 30,000, sq. ft. of heating surface and is heated by a two-pipe steam system controlled by one pulsating flow valve, one motorized bypass and orifices in the branch mains and at radiators. Returns are trapped into a dry return main and vented to the atmosphere at six separate points. Unusual changes in elevation in the supply piping result in slightly more steam being delivered to the far radiators than to the near ones. Standby control and float switch are not required. A separate steam supply line was run to the biology department "rat" room to furnish 24-hr. service there without wasting steam in the balance of the building.

The schedule for this and other classroom buildings provides for the maintenance of 72° from 9 a.m. to about 5 p.m. when temperatures are allowed to fall slowly until 9 p.m. when steam is shut off. In weather around freezing steam is shut off for an hour or two at noon, and in mild weather it is shut off just after classes enter the building in the morning and afternoon to avoid overheating.

Library and Infirmary

The Library Building has high ceilings, high windows, and large heat loss through the roof. It is heated by cast iron radiators installed in the outer wall behind the book stacks with air outlets eight feet or so from

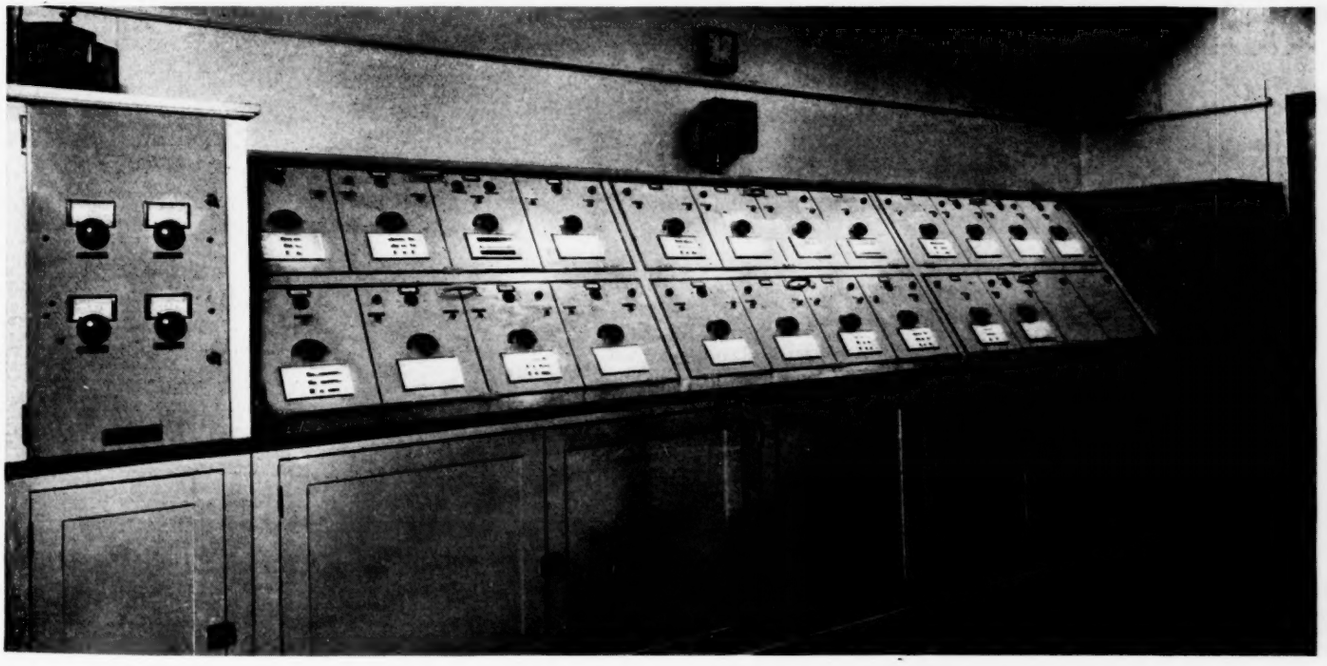


Fig 2. Heating system control panel for the 32 buildings at Mount Holyoke College.

the floor. For these reasons heating is somewhat difficult, heating up is slow and this building requires longer hours of heating and greater steam delivery than would normally be necessary.

The heating system is two-pipe with one pulsating flow control valve and bypass for operating the piping.

The Infirmary is heated by a gravity hot water system. Each hot water generator in the building is supplied with steam from the central plant through a pulsating flow control valve and an orifice at the generator so that the temperature of the hot water in the heating system is adjusted from the central plant. Steam for domestic hot water and for some few radiators is taken off the mains ahead of the generators. Heating generally is required 24 hr. daily and temperatures have been very uniform and satisfactory. Each hot water generator is fitted with a battery of air valves to freely vent the steam coils. Returns are drained through a water line float trap into the campus return.

The Arboretum is also heated by a gravity hot water system utilizing steam from the central plant in hot water generators located in the Arboretum. The water storage of the radiation and piping in this building is large by comparison with the storage capacity of the generator with the result that the system is sluggish. The frequent changes in heat from the sun cannot be met quickly enough by changes in heat delivery from the radiation with the result that overheating and underheating occur to some extent. These difficulties could be improved by adding a circulating pump for the hot water, or, better still, by the use of steam in the radiators. In general heating is reduced on sunny days and increased at night.

Other buildings were handled similarly depending on the piping arrangements and heating requirements.

Operating Results

The operating results obtained the first year of operation are necessarily hardly representative as a considerable portion of the year was taken up with routine adjustment, evolving operating procedures and making a start on the training of operating personnel. Despite these disadvantages the steam consumption as indicated by test run between February 14 and February 28, 1935, demonstrates conclusively that substantial savings can be realized. The control system provides adequate facilities for effecting economy to the extent of 25%.

The control contract was placed with Warren Webster & Company, working under the direction of Clyde W. Colby and the Office of Hollis French, associated consulting engineers for the college authorities. Fred T. Ley & Company, Inc., was the general contractor, and the steamfitting work was done by Holyoke Valve & Hydrant Company.

City Smoke and Its Effects

THE following statement was recently prepared by the United States Public Health Service for the hearing on the bills for smoke control in the District of Columbia before the Congressional Subcommittee on Public Health, Hospitals, and Charities and has been printed in the report of the hearings.

The losses due to smoke may be classified as follows: economic losses due to imperfect combustion of fuels; extra expense of cleaning clothes; losses due to disfigurement of residences, office buildings, and factories (repainting, etc.); losses due to soiled merchandise in stores; injuries to grass, shrubs, and trees bordering the streets and in the parks, loss of daylight and ultraviolet light; possible injurious effects on health.

Many estimates have been made of the losses due to these various causes, but the most thorough and consistent are those made by the Mellon Institute of Pittsburgh in 1913.

It was estimated that by the proper stoking of furnaces 21.7% of the fuel could be saved, and that the loss due to imperfect combustion in Pittsburgh at that time was $1,520,000 during the year, or a loss for each man, woman, and child of about $2.80 per year.

It was also estimated that the extra expense, due to smoke, of cleaning clothes, laundry, and dry cleaning bills in Pittsburgh in 1913 was about $2,250,000, or $4.10 a person.

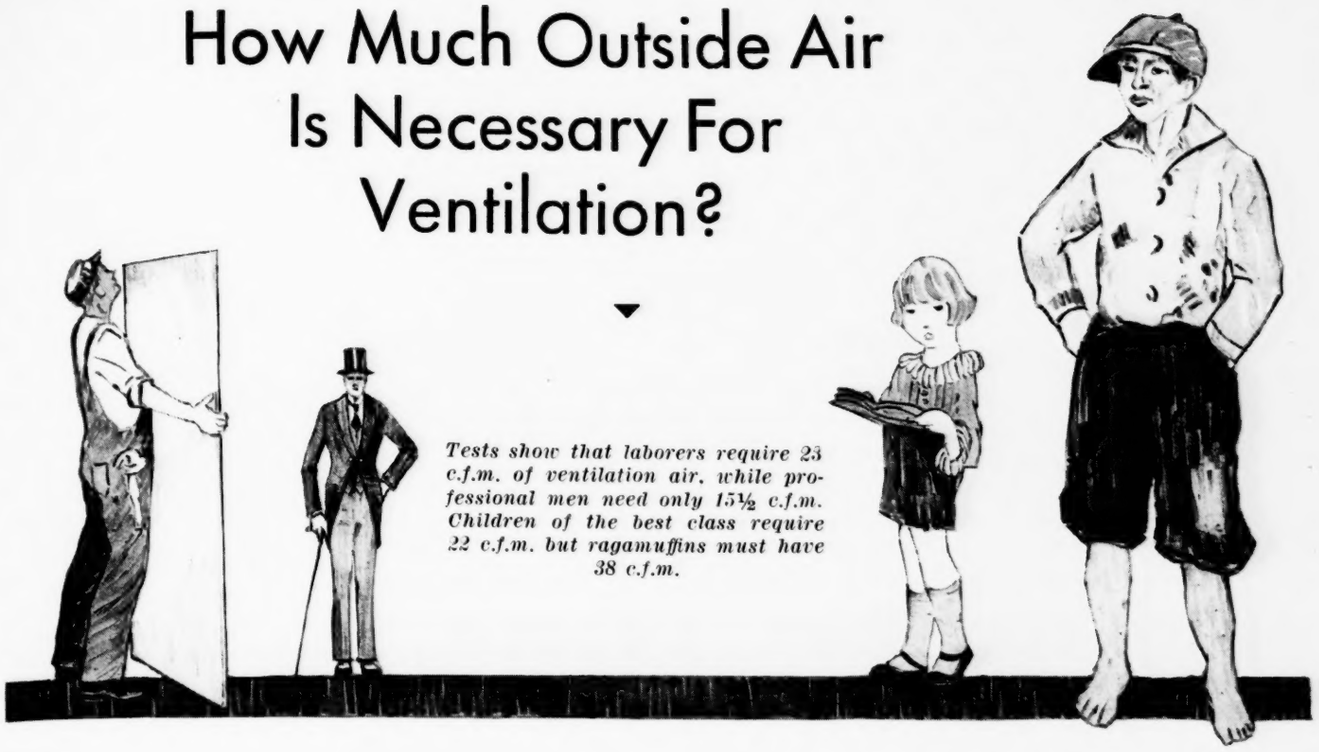
The estimated expense attributed to the necessity for repairing residences because of soiling by smoke, such as repainting, repapering, and replacing hangings, was $1,240,000, or $2.26 per person per year.

It was also reported that, in Pittsburgh in 1913, the estimated loss due to merchandise in the stores being soiled or ruined by smoke was $1,650,000, or a loss of $3 per person per year.

The sum of the losses from the four sources mentioned is $12.16 per person per year. The total loss due to smoke in Pittsburgh during 1913 was estimated at $10 million, or $20 for every man, woman, and child. In surveys made in New York, Chicago, Salt Lake City, Boston, and Baltimore, the economic loss has been estimated at from $10 to more than $30 per person per year.

The United States Public Health Service found during the years 1932 and 1933 that smoke and dust were deposited at the rate of 296 tons per square mile per year in Washington at Seventh and B Streets SW., of which 154 tons were carbon and 142 tons were ash.

How Much Outside Air Is Necessary For Ventilation?



Tests show that laborers require 23 c.f.m. of ventilation air, while professional men need only 15½ c.f.m. Children of the best class require 22 c.f.m. but ragamuffins must have 38 c.f.m.

WHAT makes human ventilation necessary? If ventilation is necessary, what determines how much ventilation air is required?

Both of these questions have been pondered on and worked over for many years by engineers. Readers who have followed the series of articles on Getting Down to Fundamentals will recall that neither heat nor moisture removal was the factor forcing the use of ventilation air but that odors, bacteria, and dust were probably the three critical factors. Of these three, it was pointed out[1] that dust may be removed from the air with facility and that bacteria are ordinarily of no great importance except in hospitals, so far as ventilation is concerned. This leaves odors as probably the limiting factor in any consideration of either the necessity for human ventilation or in fixing the amount of ventilation air required for this purpose.

A recent paper, "Ventilation Requirements," presented at the annual meeting of the American Society of Heating and Ventilating Engineers, throws additional light on this subject. This paper, probably the best which has appeared on the subject, attacked the problem from the standpoint of body odors. The object was to study the general problem of human ventilation odors under normal conditions comparable to those in schoolrooms, offices, and homes by means of applying an odor scale for studying the factors affecting odor intensity in a confined space. The results of these tests are worth careful consideration and are reported on this and the following pages. The essential points of the results appear in some detail, with much of the contributory data, method of conducting the tests, and such information omitted.[2]

This article, together with the curves and tables, is based on the report of experiments made by Prof. C. P. Yaglou, E. C. Riley, and D. I. Coggins, all of Harvard University, presented at the 42nd annual meeting of the ASHVE, entitled "Ventilation Requirements," a progress report of research sponsored by the American Society of Heating and Ventilating Engineers in cooperation with the School of Public Health at Harvard.

In interpreting the results, it should be kept in mind that the paper deals with body odors, but does not take into consideration related odors, such as tobacco smoke and perfumery. Also, the odor intensity is in a sense measured by judgment and not by an instrument of a known range of accuracy. Consequently, the figures given on the graphs and tables should be considered not too literally, but rather as an approximation of what may finally prove to be the exact figure.

Source of Odors

Odors in living rooms come mostly from the occupants themselves and are due to foul breath, decaying teeth, sweat, gases from the stomach and bowels, and decomposition of matter from the skin and clothes. Even healthy and clean persons freshly after a bath give off an appreciable amount of odor. Such odors, according to the authors, are not known to be harmful but they induce a feeling of stuffiness and discomfort to anyone coming from outside. In addition, sensitive persons are sometimes affected in a pathological way by sitting in such rooms.

How Odor Was Determined

Two identical rooms were carefully sealed. One, the experimental room,

[1]See "Getting Down to Fundamentals" Part 7—Conclusion Regarding the Determination of Amount of Ventilation Air Necessary, October, 1935, page 52.

[2]The data covered in the tests deal with more or less comfortable conditions of temperature and humidity in the winter and summer. Observations with high and low humidities and with temperatures nearer the upper and lower boundaries of the comfort zone are yet to be completed.

TABLE 1.—SENSORY INTENSITY SCALE OF BODY ODOR

Odor Intensity Index	Characteristic Term	Qualification
0	None	No perceptible odor.
½	Threshold	Very faint, barely detectable by trained judges; usually imperceptible to untrained persons
1	Definite	Readily detectable by all normal persons but not objectionable.
2	Moderate	Neither pleasant nor disagreeable. Little or no objection. Allowable limit in rooms.[3]
3	Strong	Objectionable. Air regarded with disfavor.
4	Very Strong	Forcible, disagreeable.
5	Overpowering	Nauseating.

[3]Note that an odor intensity index of 2 is the allowable limit in rooms and this index is so noted on charts appearing later.

was occupied by the subjects who constituted the source of odor production. The other room was a control room for the judges. A small tight door was cut in the common partition to allow direct passage of the judges from the control room to the experimental room. Separate air conditioning units installed in the corridor kept the two rooms at approximately the same temperature and humidity with the only variable factors in the two rooms being the outdoor air supply and number and type of occupants.

The control room was supplied with 50 c.f.m. of outdoor air per person so that the air in this control or judges' room was maintained at a condition where odors were not perceptible. The judges passed one at a time into the room and passed on the air conditions according to the scale in Table 1.

How Much Outdoor Air is Necessary?

Fig. 1 shows how a change in the quantity of outdoor air supplied affected the odor intensity for both adults and children. Recirculation did not seem to affect the odor strength appreciably. In other words, from the standpoint of body odor, a room can be ventilated just as well with an outdoor air supply of 16 c.f.m. per person as with a total supply of 30 c.f.m., about

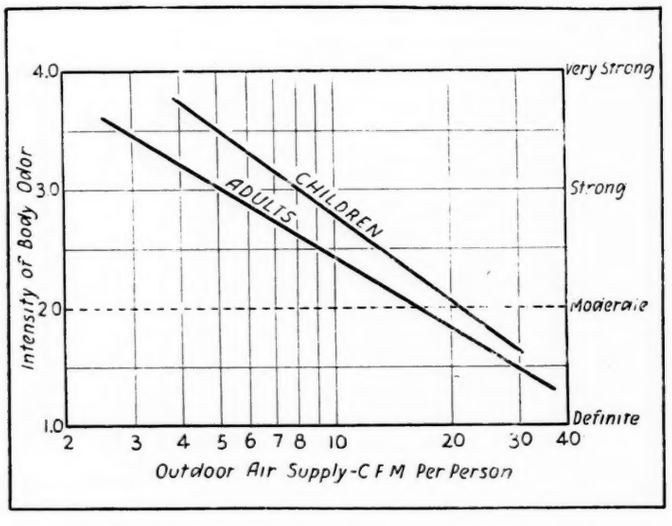


Fig. 1. Outdoor air and its effect on odors. An index of odor intensity of 2.0 is desirable. The curve applies to average persons and children.

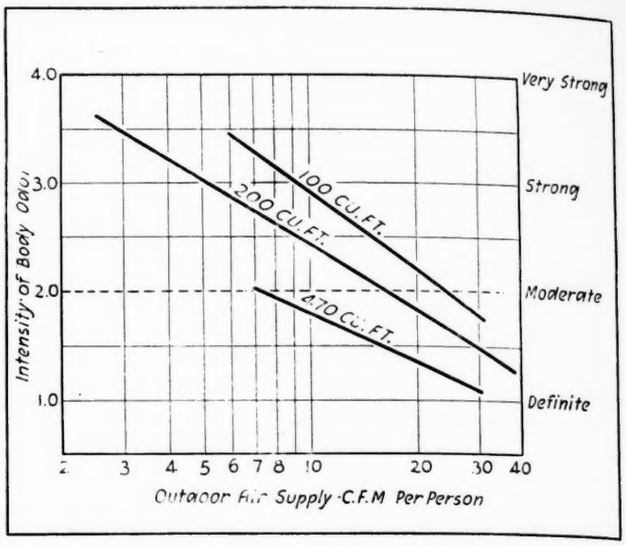


Fig. 2. Influence of crowding adults on odor. Figures show the air required when each occupant had 100, 200, and 470 cu. ft. of space each.

one-half of which is recirculated. Recirculation is often desirable for adequate distribution and temperature control, but one of the disadvantages is that it smells up the ducts and fans and, unless the system is flushed frequently with clean air, higher air quantities will be needed to obtain satisfactory results.

Effect of Sex

Sex was not a factor in odor intensity and ventilation requirements in all instances in which female subjects used no perfumery of any sort, including face powder, before coming to the tests. Results of two series of experiments with men and women subjects, under comparable conditions, are shown in Table 2. Similar tests with grade school boys and girls showed no appreciable difference in odor intensity that could be attributed to sex.

Effect of Age

School children between 7 and 14 years old require a different amount of outside air for ventilation in spite of their smaller body surface and lower total metabolism. Whereas in the case of adults an outdoor air supply of 16 c.f.m. per person was sufficient to take care of objectionable body odors, for children this figure was 21 c.f.m. per child.

However, adolescent boys and girls between 16 and 20 years of age yielded results closer to those of adults. In general, it may be assumed that the requirements of children of this age and adults are practically the same.

Effect of Crowding

By placing a different number of subjects in the test room, thus decreasing the amount of floor space and

TABLE 2.—INTENSITY OF BODY ODOR WITH MEN AND WOMEN SUBJECTS UNDER COMPARABLE CONDITIONS

Subjects	Air Space per Person Cu. Ft.	Aver. Outdoor Air Supply per Person, C.F.M.	Average Odor Intensity
Women	200	15.8	2.05
Men	200	15.9	2.00

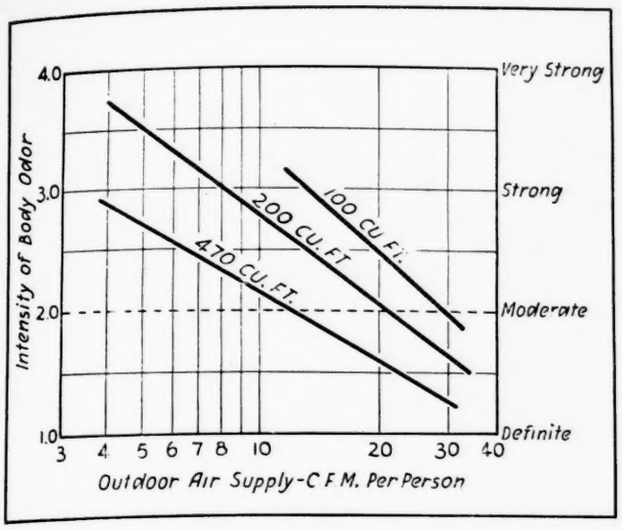


Fig. 3. Influence of crowding children on odor. Figures show the air required when each occupant had 100, 200, and 470 cu. ft. of space each.

the amount of volume allotted to each person, experiments were made to determine the effects of crowding in rooms. Figs. 2 and 3 show the influence of changing air space on odor intensity with adults and with children. The three curves represent a floor area of 11, 22, and 52 sq. ft. per person and volumes of 100, 200, and 470 cu. ft. respectively.[4]

With 470 cu. ft. of air space per person (equivalent to conditions in homes and uncrowded offices) the air requirement from the standpoint of odor was 7 c.f.m. per person. With 200 cu. ft. of air space, it was 16 c.f.m. per person, and with 100 cu. ft. air space it was 25 c.f.m. per person.

Computing Ventilation Requirements

From the data as shown in the previous charts two working charts have been prepared for computing the ventilation requirements of adults and children from the standpoint of body odor. These charts, Figs. 4 and 5, are the practical results of the whole investigation.

Fig. 5, for computing the ventilation requirements of grade school children, is, it should be noted, for average children only. By that is meant that children of the poorest classes who bathe infrequently and children of the best classes who bathe very frequently are not within the scope of this chart.

Effect of Social and Income Status

All of the figures so far presented have dealt with adults and children of average classes, that is those of balanced socio-economic status and habits of personal hygiene. A special series of experiments was attempted to study maximum variations from the average by using a limited number of subjects of the poorest and best classes. For example, with adult subjects, laborers (janitors and street workers) and medical students were used. In the case of children the principal and nurse of a school selected two groups and those conducting the test selected a third one from a different district, the last being children given daily baths and the best of care.

With equal ventilation rates the laborers gave off considerably more odor than the medical students and therefore the ventilation requirements should be greater. The air flow to maintain the odor level at an index of 2.0 is 23 c.f.m. per laborer and 15.5 c.f.m. per medical student. Similarly, the requirements of school children were found to vary from 18 to 38 c.f.m. per child according to the socio-economic scale.

Effect of Bathing

Fig. 6 shows the results of tests on school children and adults based on the number of days since the last bath and the effect of this bathing or lack of bathing on the ventilation requirements. Among those who bathed frequently the ventilation requirement of the children was about 10% in excess of cleanly adults, but after a week the difference increased to 50%. The outstanding point of this chart is that once the minimum

[4]The tests were run in a room with a ceiling height of 9 ft. 2½ in. No tests were run with higher ceiling heights and there is no way of knowing whether the values obtained in these tests would hold with ceiling heights greater than 10 ft., such as encountered in theaters.

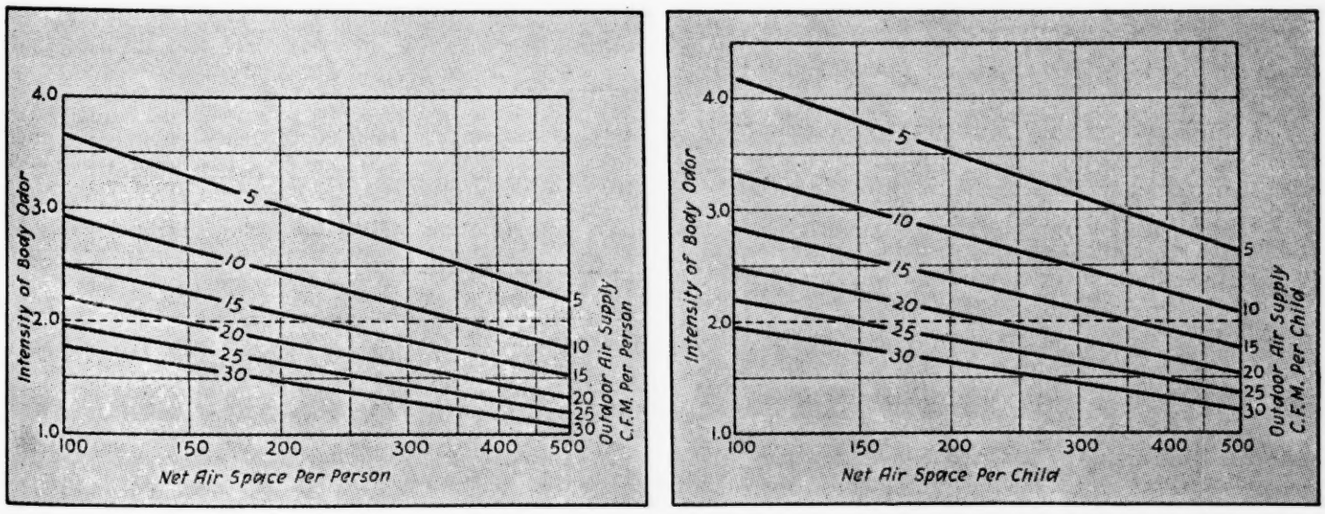
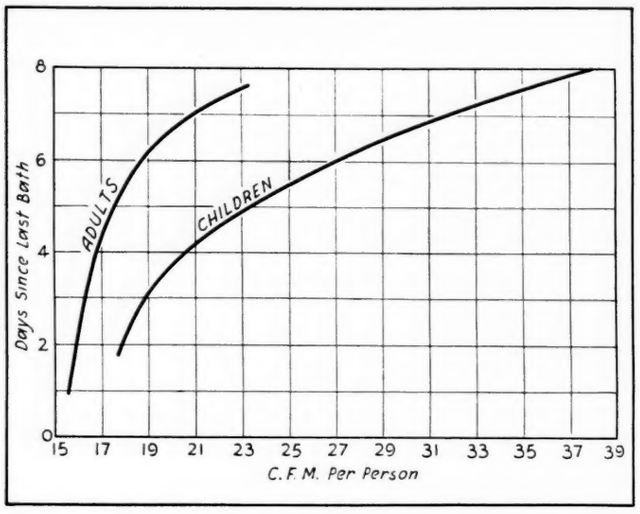


Fig. 4. (Left) Chart for computing the amount of ventilation air for sedentary adults from the standpoint of body odor. If each adult in a room has 250 cu. ft. of space, follow vertically from 250 to the dotted line, 2.0. Interpolating between the slanting lines we find that 14 c.f.m. of outside air are required per person. Fig. 5. (Right) for children is used similarly. Both apply to those of average cleanliness.



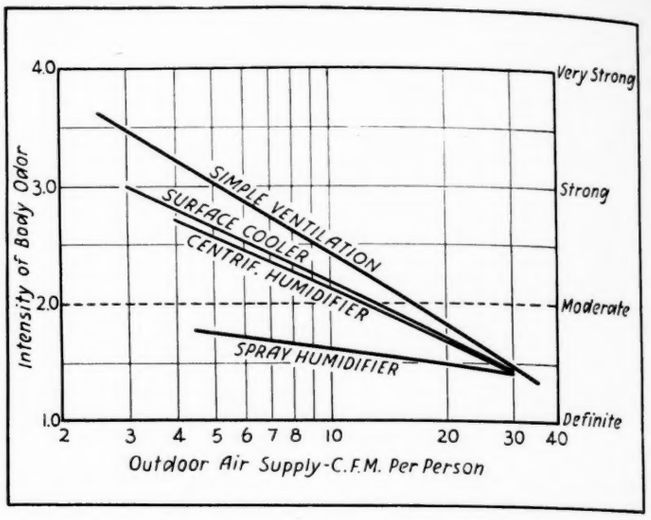


Fig. 6. (Left) Allowing an odor intensity of 2.0, this chart shows the effects of bathing (and lack of bathing) on the amount of ventilation air required. Based on a space of 200 cu. ft. per occupant. Fig. 7. (Right) Odor removing capacity of air conditioning devices of various types. Based on use of clean water with each occupant receiving 30 c.f.m. of air and occupying 200 cu. ft. of space.

ventilation requirements are fixed for any given conditions, the problem of body odor control resolves itself into personal factors of hygiene and sanitation—factors over which the ventilating engineer has no control.

Influence of Air Conditioning on Air Requirements

Three different arrangements of washing, humidifying, and cooling recirculated air were found to remove considerable amount of odor. Three different arrangements were studied as follows:

1—Mixture of outdoor and recirculated air passed through a conventional spray type dehumidifier for cooling and dehumidifying the air of the experimental room in warm weather.

2—Mixture passed through a centrifugal humidifier, for humidifying the air in cold weather.

3—Mixture passed over a surface cooler through which cold water between 35° and 50° was circulated. The cooler used in these experiments was capable of lowering the temperature of the air passing over it (210 c.f.m.) through a maximum of about 10°.

Fig. 7 shows the results of these tests. The surface cooler absorbed the least amount of odor and the dehumidifier the most.

The outdoor air requirement was reduced from 16 c.f.m. per person with simple ventilation to about 13 c.f.m. per person when the mixture of outdoor and recirculated air was passed through the centrifugal humidifier or over the surface cooler, and to less than 4 c.f.m. per person when the mixture was passed through the spray dehumidifier.

In this connection, however, the cleanliness of the spray water is of the utmost importance. One experiment using old water from a previous test which had stood in the brine cooler for 8 days resulted in a worse odor condition than any other test.

Table 3 summarizes the minimum outdoor air requirements for ventilation under various conditions as determined by the investigators. As the authors point out, the figures are provisional and subject to revision upon completion of the investigation.

Conclusions

Outdoor air requirements for ventilation under comfortable conditions of temperature and humidity have been determined from primary impressions of odor intensity upon entering occupied rooms and from impressions of the occupants themselves after exposures of 3½ hr. to the conditions investigated.

Wide individual variation occurred in the amount of

TABLE 3.—SUMMARY OF MINIMUM OUTDOOR AIR REQUIREMENTS FOR VENTILATION

(Provisional values subject to revision on completion of project)

Type of Occupants	Air Space per Person, Cu. Ft.	Ventilation Requirements, C.F.M. per Person	Under These Conditions—
Adults			
Average sedentary	100	25	Heating season with or without recirculation. Air not conditioned.
Average sedentary	200	16	
Average sedentary	300	12	
Average sedentary	500	7	
Average sedentary	200	12	Heating season. Air humidified by centrifugal humidifier.
Average sedentary	200	4	Summer season. Air cooled and dehumidified by spray humidifier.
Laborers	200	23	Heating season with or without recirculation. Air not conditioned.
Children			
Average grade school	100	29	Heating season with or without recirculation. Air not conditioned.
Average grade school	200	21	
Average grade school	300	17	
Average grade school	500	11	
Grade school, poor class ...	200	38	
Grade school, better class ..	200	18	
Grade school, best class	100	22	

odor emitted by various groups of persons, according to socio-economic status, especially the bathing habits of individuals and cleanliness of clothing. Children, as a rule, gave off more odor than adults, and their bathing habits were deficient.

Even healthy clean persons freshly after a bath gave off an appreciable amount of odor which required from 15 to 18 c.f.m. of outdoor air per person in order to dilute it to a concentration that was not objectionable to persons entering the room from relatively clean air. A week after a bath the ventilation requirement of children increased from 18 to 29 c.f.m., as compared with an increase of from 15 to 20 in the case of adults.

Untreated recirculated air in any amount had no effect on odor intensity or quality of air.

The usual processes of washing, humidifying, cooling, and dehumidifying recirculated air apparently removed a considerable amount of body odor and, under certain conditions, practically the maximum amount possible by the use of known processes. It is important to note, however, that the water circulating through humidifiers or washers in these tests was clean and fresh and that in an old system or with stale water it is possible to get results which differ widely from those found in the tests. In fact, it is possible to require more ventilation air with washers using old water than would be required otherwise.

Under comfortable conditions of temperature and humidity, both primary and secondary impressions of air quality were found to be related closely to the concentration of odor in the air, despite the fact that the occupants themselves could not smell the odor.

Based upon these impressions, two sets of ventilation requirements were derived for various groups of individuals under various conditions as summarized in Table 3. The impossibility of fixing any single standard that would apply under all conditions is clearly evident. Each case, it would seem, must be considered on its own merits.

From the standpoint of the user of these data it should be emphasized that the odor index of 2 which is the threshold of odor perception is based on a judgment scale and may differ among different judges. Consequently, in interpreting the tables and graphs too much emphasis should not be laid on the exact figure given at the intersection of a curve or in the tabulation material. If, for example, under a certain set of circumstances the graphs and tables give a figure of 16 c.f.m. it might easily be that a different set of experiments with different judges might possibly yield data which would give a figure of 14 c.f.m. or 18 c.f.m. In other words, it is not possible at this time to state the limits of accuracy of the tests.

Further points to be noted are that the tests deal only with ventilation from the standpoint of body odor and not with related human odors, such as smoke and perfumery. The report, as pointed out earlier in these pages, is a progress report and the results are tentative pending further work. Therefore, readers should use their judgment as to how far they would want to go in changing their existing practices or standards to conform with the findings presented here.

Electric Boiler Cuts Heating Costs

ELECTRIC steam boilers are used extensively to utilize power from hydro-electric plants at times when the water otherwise would run to waste, such as during high water, over week-ends and holidays. We have worked out a system of operation in our 200-ton newsprint pulp and paper mill at Woodland, Me., whereby our electric steam boiler can be used economically during periods when the river is under control and it is desirable to hold water in storage.

Power at this mill is supplied by two hydro stations and a steam plant. The latter comprises a 7,430-sq. ft. boiler, two 7,490-sq. ft. boilers, all pulverized-coal fired, one 8,430-sq. ft. stoker-fired boiler, a refuse-fired boiler with 3,140 sq. ft. of water heating surface, and one 6,000-kw. electric steam boiler.

Up the St. Croix River 11 miles above the mill, a 9,000-kw. hydro-electric plant supplies power to the mill over a 33,000-volt transmission line. At the mill itself is a 2,200-kw. hydro plant. During high water, both hydro plants are operated.

The electric boiler, originally installed to utilize excess hydro-electric power during high water, is also used now when the river flow can be controlled, to permit the steam plant to shut down week-ends.

Before we installed an automatic heating system control it required about 100 tons of coal to maintain steam pressure and supply steam for heating and other purposes over Saturday and Sunday. Now by generating about 200,000 kw-hr. extra with steam during the week, which can be done with a high-pressure turbine from about 30 tons of coal (4,000 B.t.u. per kw-hr.) load can be reduced on the hydro plant and the water stored. Then over the week-end this water is used in the hydro plant to generate power for the electric boiler while the coal burning plant is shut down. This operation, combined with automatic heating system control, saves about 100 — 30 = 70 tons of coal each week-end when there is not an excess of water.

This is an unusually interesting application of an electric steam boiler to save fuel. It shows that such a boiler may have an important place in power system operation in low water periods as well as in high water seasons. In this particular case the hydro plant has to be operated over the week-end to supply the town lighting load and power for other small services. Consequently, it costs practically nothing to produce power for the electric steam generator, other than the cost of coal. Operation of the electric boiler also reduced the amount of labor necessary to keep steam on the plant over the week-end.—*John P. Topolosky in "Power."*

A Psychrometric Chart with Barometric Pressure as a Variable

With the general chart described here the density of the air-vapor mixture can be readily determined for standard as well as other pressures

By J. S. CHANDLER†

THE conventional psychrometric chart is conveniently arranged and is suitable for the solution of certain problems. However, it has two serious limitations—it is good only for a barometric pressure of 29.92 in., and the density of the air-vapor mixture cannot be readily determined.

In certain classes of engineering work, such as the operation of air conditioning equipment, low pressure fans and air metering devices the pressure of the air-vapor mixture may be considerably greater or less than standard barometric pressure. It becomes necessary to consider the effect of pressure in the calculation of such items as absolute humidity, specific volume of dry air, enthalpy of mixture, and density of mixture, all of which vary nearly directly (or inversely) as the total pressure. In fan work and for metering devices such as orifices, venturi meters and pilot tubes, it becomes necessary accurately to determine the density of the air-vapor mixture at various points in the set-up. This cannot ordinarily be found from the usual chart.

The General Psychrometric Chart, Fig. 1, is introduced by the author for use in finding the common psychrometric properties for a large range of barometric pressures. In addition, the mixture density may be directly and accurately determined, not only for the pressure and temperature at which wet and dry bulb observations are made but for any new pressure and temperature to which the same air may be compressed or expanded. At the same time an attempt has been made to retain, as far as possible, the convenient arrangement and readability of the present charts.

Accuracy of the Chart

It is possible to read any value from the chart within its range of temperature and pressure with an accuracy limited only by the mechanical errors introduced in plotting the lines and the observer's skill in reading the chart. This is in the range of accuracy of values read from a 10-in. slide rule for relative humidity, dewpoint, vapor pressure, absolute humidity, and enthalpy, and at least three times as accurate as the slide rule for values of density and specific volume of dry air and air-vapor mixtures.

Such accuracy is, however, inconsistent with the accuracy of most observed data. If the wet and dry bulb errors are not known to be less than 0.5° (an error in wet bulb temperature is more serious than the same error in the dry bulb), the vapor pressure correction shown in the upper left hand corner of the chart may be neglected. Nevertheless, the correction should be applied in all cases where the wet bulb depression is greater than 20° and the barometric pressure is below 28 in. or above 30 in. (the correction is zero for saturated air). Practically all cases fall within these limits and the reading of the chart is simplified accordingly.

How to Read the Chart

As an example, find the properties of air at 80° dry bulb, 60° wet bulb, and 30 in. Hg. barometric pressure (Fig. 2). From the dry bulb reading on the horizontal scale at the bottom on the left end of the chart go vertically to the 60° wet bulb line and read relative humidity, 30%. From this point go horizontally to the left and read dewpoint, 45.5° on the saturation line, or go horizontally to the right and find partial pressure of vapor, 0.308 in. on the vertical scale marked Vapor Pressure. Continue to the right to the 30 in. barometric pressure line and read absolute humidity, 45 grains of moisture per pound of dry air. From this point proceed vertically to the 80° dry bulb line, then to the right as indicated on diagram and read density of dry air in mixture, 0.0730 lb. per cu. ft. on the vertical scale, or specific volume of dry air in mixture, 13.70 cu. ft. per lb. on the parallel vertical scale.

To determine the enthalpy of the mixture go vertically from the intersection of the 60° wet bulb line and the saturation line on the left hand portion of the chart to the curved line marked 30 in. barometric pressure, then to the left and read enthalpy of mixture, 26.5 B.t.u. per lb. of dry air. This enthalpy is referred to 0° for the dry air portion and to 32° for the vapor portion. This value, however, will be found to be slightly greater than that given by some other charts due to the fact that the heat of the liquid of the vapor portion is included. The enthalpy correction shown on the upper left hand corner of the chart for humidities less than 100% need not be used except for high wet bulb temperatures accompanied by a large wet bulb depression.

To find the density and specific volume of the mixture for the previous example refer to Fig. 3. Locate the dewpoint temperature, 45.5° (determined as before) on the vertical scale called Dewpoint Temperature at the center of the chart; proceed horizontally to the right to the 30-in. line, up to the 80° dry bulb line, and then to the right where the readings are found,

†Graduate Instructor in Mechanical Engineering, Georgia School of Technology.

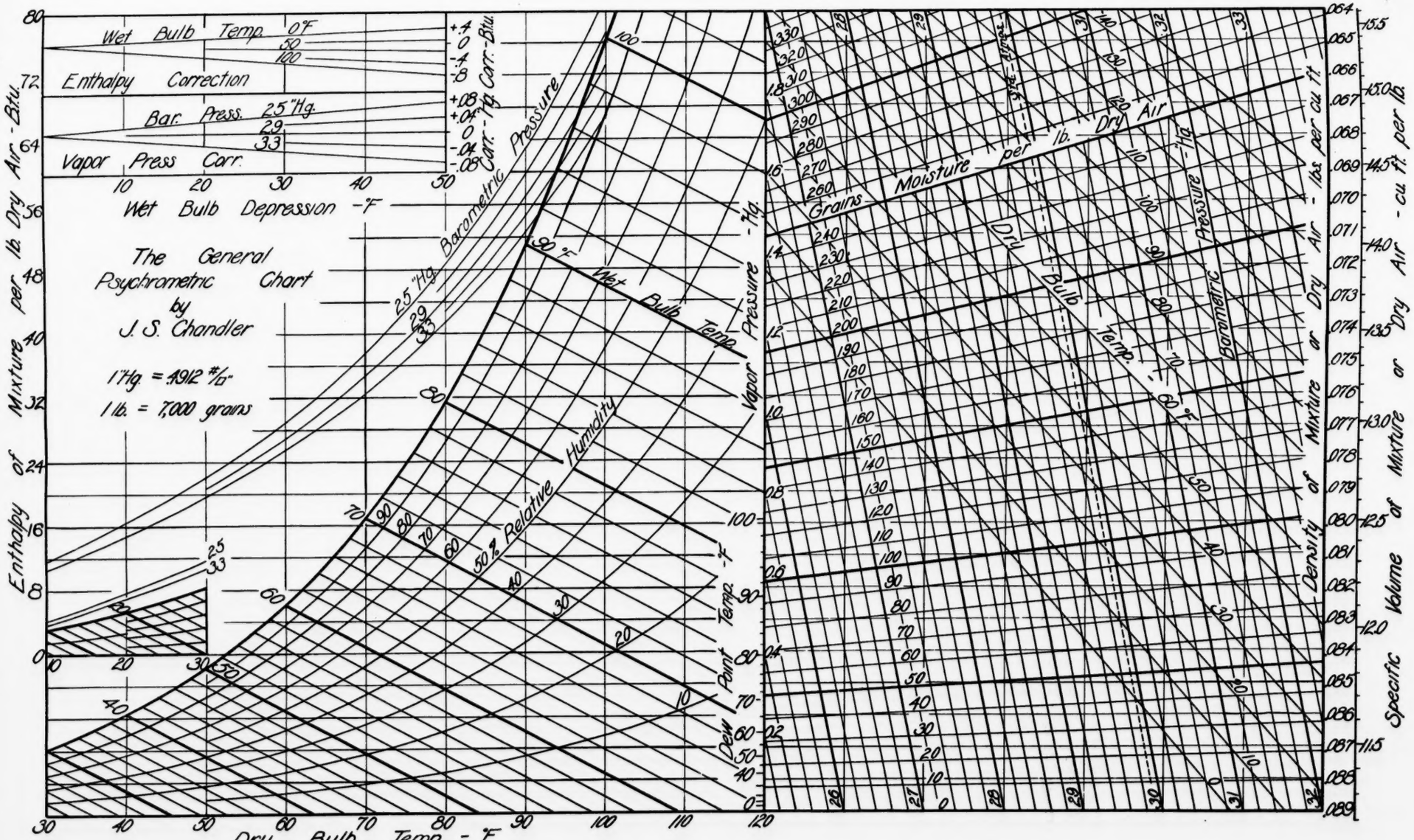

The General Psychrometric Chart
by
J. S. Chandler
1"Hg. = .4912 #/in²
1 lb. = 7,000 grains
Wet Bulb Temp. 0°F
50
100
Enthalpy Correction
Bar. Press. 25"Hg.
29
33
Vapor Press Corr.
Wet Bulb Depression -°F
Corr. -"Hg. Corr. -Btu.
Enthalpy of Mixture per lb. Dry Air - Btu.
Dry Bulb Temp. - °F
Barometric Pressure
Vapor Pressure - "Hg.
Wet Bulb Temp.
Dew Point Temp. -°F
50% Relative Humidity
Grains Moisture per lb. Dry Air
Dry Bulb Temp. -°F
Barometric Pressure - "Hg.
Density of Mixture or Dry Air - lbs per cu ft.
Specific Volume of Mixture or Dry Air - cu ft. per lb.

Fig 1.

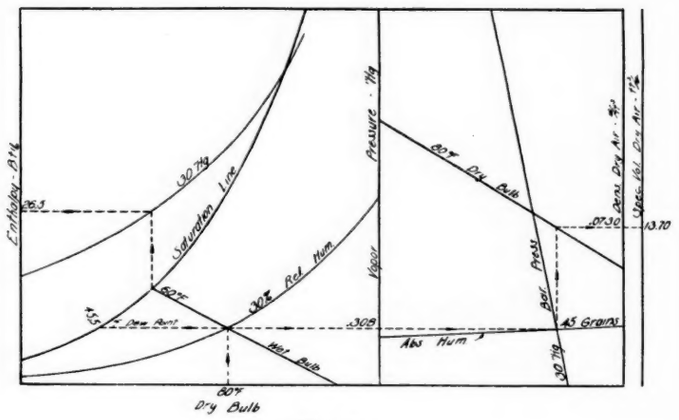


Fig. 2.

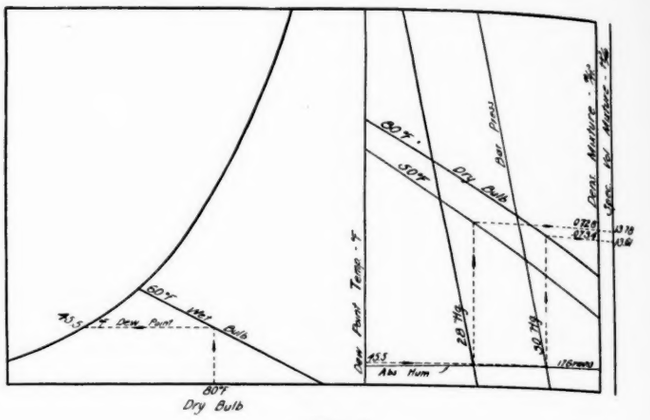


Fig. 3.

density 0.0734 lb. per cu. ft. and specific volume 13.61 cu. ft. per lb.

Use of Chart for Other Conditions

Suppose this same air has its pressure changed to 28 in. and its dry bulb temperature changed to any new temperature not below the dewpoint, say 50°, at which the mixture density or specific volume is desired. This is a process of constant absolute humidity. Start out as before by locating 45.5° on the dewpoint temperature scale, move to the right to the 30-in. line, then follow a line of constant absolute humidity to the new pressure, 28 in., thence up to the 50° dry bulb line and over as before to read density, 0.0726 lb. per cu. ft. and specific volume, 13.78 cu. ft. per lb. It will be noted that the absolute humidity reading, 17 grains per lb., is not the true absolute humidity, 45 grains per lb., as determined above. Our purpose is accomplished, however, quite without regard to the value marked on the line.

It is worth while to point out that very little error is introduced in assuming the process to be that of constant dewpoint temperature (constant vapor pressure) rather than constant absolute humidity, since the absolute humidity lines are nearly horizontal on this portion of the chart. Another short cut is simply to take the wet bulb temperature in place of the dewpoint temperature, thus eliminating the necessity of first determining the dewpoint temperature. The error resulting from such a procedure is less than 0.3% for wet bulb depressions less than 20°.

For the special case in which the temperature is dropped below the dewpoint in any state change, the lowest temperature reached during the process becomes the new dewpoint. This is to be used in determinations of mixture density or specific volume. If the air is heated after having been cooled below the dewpoint, the heating process is that of constant absolute humidity. For the case in which the air contains no moisture, its density and specific volume may be determined by selecting the intersection of the barometric pressure line with the zero absolute humidity line and proceeding up and over as before.

For cases in which the wet and dry bulb temperatures have been accurately determined and the barometric pressure differs materially from 29 in. (the basis upon which the chart is constructed), it becomes advisable to apply the vapor pressure correction. From the wet bulb depression on the abscissa scale (see inset on upper left hand portion of the chart) go vertically to the barometric pressure line and read the correction from the ordinate scale on the right. This correction is to be added algebraically to the vapor pressure reading as determined above. All the other psychrometric properties are then found by using this corrected vapor pressure. The effect of this correction is negligible in determinations of density and specific volume and, of course, has no bearing on the enthalpy determination.

If the relative humidity, dry bulb temperature, and barometric pressure are given, the vapor pressure and all dependent properties except the wet bulb temperature and enthalpy are accurately determined without the application of the vapor pressure correction. It becomes necessary to subtract algebraically the vapor pressure correction from the actual vapor pressure if the wet bulb temperature is to be determined accurately. The wet bulb temperature is read at the intersection of the "uncorrected" vapor pressure and the dry bulb temperature lines. The enthalpy is determined from this wet bulb temperature.

Strictly speaking a line of constant wet bulb temperature is not a line of constant enthalpy. This would be the case only if the heat of the liquid of the vapor were neglected. The effect of the heat of the liquid may be neglected in all cases where extreme accuracy is not desired and where the wet bulb depression is not excessively large. The proper correction (to be added algebraically) may be determined from the inset in the upper left hand corner of the chart in much the same manner as the vapor pressure correction. Note that the correction is zero for saturated air (zero wet bulb depression) and that it is also zero when the wet bulb temperature is 32° (heat of the liquid is zero at this temperature).

Construction

Contrary to customary practice this chart is not constructed on the basis of standard atmospheric pressure, but rather on the basis of 29 in. This is about the average pressure existing at Atlanta. Perhaps 30 in. would be more suitable for locations near sea level.

The vapor pressure can of course be determined for any barometric pressure by applying the correction given on the chart.

Use of Vapor Pressure as Ordinate

There are a number of reasons why vapor pressure rather than absolute humidity was chosen as the ordinate scale of this chart. The most important reason is that the vapor pressure changes less with a given change in barometric pressure. As a result the vapor pressure correction may be disregarded without objectionable consequences in most cases. This can best be illustrated by an example. The partial pressure of the vapor for a dry bulb of 80°, a wet bulb of 60°, and a barometric pressure of 30 in. is 0.301 in., the absolute humidity is 44.2 grains per lb. of dry air. If these properties were determined from a chart based on 29 in. and no corrections made the results would be, vapor pressure 0.309 in. and absolute humidity 46.9 grains per lb. The resulting errors would be 2.66% for the vapor pressure and 6.11% for the absolute humidity. A wet bulb depression of 20° was chosen for this example since it is about the maximum encountered in engineering work. The comparison is even more striking at lower wet bulb depressions. If saturated air at 80° is used in the above example the result is zero error for vapor pressure and 3.57% error for absolute humidity.

Another important reason for using vapor pressure as the ordinate scale is the convenient arrangement which it permits for the right hand portion of the chart.

If the initial observations are made with a hair hygrometer or other means of determining the relative humidity directly, the vapor pressure and other properties can be accurately determined from the chart without making any corrections. This would not be the case if absolute humidity were used as the ordinate scale.

Using vapor pressure as the ordinate causes the wet bulb lines to be straight. This is otherwise not the case.

The gas constant for water vapor was taken as 1.212 (based on pressures measured in inches of mercury) in all calculations. This was determined from Keenan's steam tables and is correct within 0.1% for the range of pressures and temperatures covered by the chart. The gas constant for dry air was taken as 0.7541 for pressures in inches of mercury.

The abscissa scale for the right hand part of the chart is $(P_m - P_v)$ although of course it is not labeled as such. The other scales on this part of the chart are so chosen as to give straight line relationships for all plotted values. The specific volume scale is a reciprocal scale parallel to the density scale.

Grains of moisture per cubic feet of dry air cannot be read directly from the chart. This quantity may be obtained by dividing the grains of moisture per pound of dry air by the specific volume of the dry air.

A little practice with the chart will indicate to the reader the proper number of significant figures to which any result should be reported. In general, with the accuracy ordinarily attained in the observed data, values of relative humidity, vapor pressure, absolute humidity and enthalpy should not be reported to more than two significant figures, while values of density should not be reported to more than three significant figures. Some degree of reliability may be placed in the fourth digit of specific volume determinations.

Heat from the Sun

DR. C. G. ABBOT, secretary of the Smithsonian Institution, who has had a lifetime of experience in measuring the sun's radiation and the flow of heat, has made various experiments in the last 20 years as a contribution to the age-old problem of using solar heating for power, cooking, and other purposes. His studies have culminated in an efficient machine demonstrated at St. Louis, December 30, 1935. A picture of the machine appears on page 47.

Doctor Abbot's improvements lie first in the cheap yet accurate and efficient ray-collector employed, and second in the highly efficient and heat-saving absorber for the collected rays. He employs a parabolic cylindrical mirror made of an alloy of aluminum. This material comes in large, thin sheets, reflects over 80% of solar rays, and has so permanent a surface that a year's exposure to the weather makes no appreciable deterioration. A simple metallic framework of aluminum and duralumin makes up a cradle of the exact parabolic curvature required. Experiment shows that a present unit mirror with a 2 ft. wide sheet about 6 ft. long will bring the sun rays to a focal line no wider than a lead pencil.

At the focus the rays pass through two concentric tubes of glass of 1¼ in. and ⅞ in. diameters, respectively, until they reach a central ½ in. tube, metal plated on the top third of its circumference, within which flows a black liquid which is a chlorinated diphenyl compound. With the addition of a little lampblack it almost totally absorbs the focused solar rays, and though still liquid when reduced to ordinary temperatures, it does not boil or flash at 662°. A high vacuum is maintained between the tubes so that heat is lost only by radiation, as in a thermos bottle.

A flow of the liquid is maintained either by gravity circulation (as for the water boiler of a domestic furnace) or by a pump. Thus the heat absorbed from sun rays is carried away to the apparatus for steam power (such as a tubular boiler) for cooking (such as a reservoir with inserted ovens) or for evaporating liquids (such as an open coil).

Experiments and theory agree in promising an overall efficiency of 15% for steam power production. This contemplates a boiler at 200° C. so that its maximum theoretical thermodynamic efficiency is about 40%. Losses by reflections, inefficiency of steam engine, etc., bring the final figure to 15%. This is a very substantial improvement on previous sun motors.

Marked Progress in Equipment Design Displayed at Chicago Show

A REPORTER looking for the "feature" of the 4th International Heating & Ventilating Exposition is faced with the same problem as a man with a rifle aiming at one of a swarm of locusts. There was no single feature, but there were an extraordinary number of attention-holding exhibits, there was enthusiasm on the part of the tens of thousands attending, and there was size and color and motion to the booths (of which there were over 300). Those in attendance were impressed by the type of visitors who came to see and to learn. Questions about the features, operation, and application of the equipment on display were intelligent and searching. Sales were definitely up. Many manufacturers lined up contacts which otherwise would have taken weeks of travelling and correspondence. Despite the elaborate displays, some exhibitors were inclined to regret that they had not contracted for more space, and had not featured their equipment even more strikingly. In most of the exhibits display technique reached a high point with the dynamic treatment predominant. The spectators could see how things worked by watching them in operation.

The Exposition was held during the same week as was the annual meeting of the ASHVE and the midwinter meeting of the National Warm Air Heating and Air Conditioning Association. Although the headquarters of both of these meetings were miles from the Amphitheatre where the exhibition was held, and although the temperature remained below zero all week, the attendance was heavy every afternoon and the show as crowded every evening. The equipment displayed covered practically everything used in the heating, ventilating and air conditioning of buildings and little was neglected, either in the range of the exhibits or in attention given them, by those who attended.

The Exhibits

The Exposition marked another stage in the transition between old time equipment for specific purpose and new type systems which serve all of the weather requirements throughout the year.

In oil burners the tendency was completely to enclose the burner and the boiler within a steel jacket which would make it more attractive in appearance without increasing the maximum dimensions. In some cases the burners were furnished with domestic hot water coils to provide hot water service without the use of a storage tank.

Quick heating with respect to water supply was offered as an auxiliary feature to several types of boiler and furnace equipment. One of the many features in conjunction with heating equipment was a safety self-relighting boiler the flame of which could not stay blown out. Use of pulverized coal for domestic heating was promoted by equipment especially designed for handling this fuel. One design for forced warm air units offered an arrangement whereby the air to be heated is returned at the top of the furnace casing and is preheated before entering the filter and blower compartment.

Air conditioning displays included many devoted specifically to the refrigerating units essential for various types of installation. Self-cleaning spray nozzles had an automatic cleaning device to function each time the water was shut off. With one self-cleaning nozzle, when the water is turned on, the part of the nozzle in which the orifice is located moves forward and remains advanced. When water is shut off, the orifice element is returned to its original position, and a cleaning pin is automatically forced through the orifice.

To minimize the expense of intra-floor ductwork one manufacturer offered air conditioning units to be located one on each floor in large buildings. A line of condensing units, ranging from 1 to 20 hp., was shown. For air conditioning executive suites, one exhibitor showed completely self-contained units, also units which operated in conjunction with condensing systems remotely located.

Space heating with gas as a fuel moved forward to take in other aspects of air conditioning. Gas fired air conditioning equipment took its place beside units operated with oil and coal. One of the gas fired air conditioners was cased in an unusually attractive cabinet of heavy weight, cold-rolled furniture steel pleasingly finished in a two-tone green color combination.

The center of interest at one booth was a working model showing the cleaning of air electrically. Power required to operate such a device, including fan for drawing the air over it, is about the same as that required for a domestic refrigerator. The device is said to have been effective for relieving asthma patients irritated by various dusts.

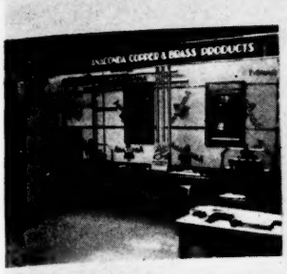
A large illuminated display at another booth showed the operation of two types of water vapor refrigeration compressors for air conditioning systems.

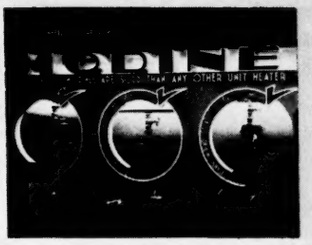
Air filters of both the permanent and "throw away" types, for use with air conditioning equipment, were shown and it was noted that in other applications the material of air filters serves as thermal insulation—such materials as glass wool, and mineral wool. Hair-asbestos combinations were offered for flexible duct insulation.

One exhibitor flowed steam through insulated and non-insulated pipes and showed the comparative amount of power which could be generated by the steam in each case. A boiler insulating cement, economical in first cost and subject to re-use, was featured.

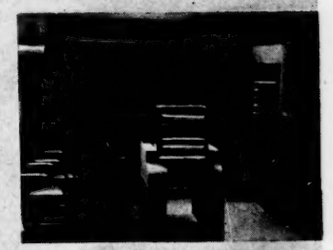
(Concluded on page 67)

Though no photographic masterpiece, this view shows the crowded aisles early one afternoon.

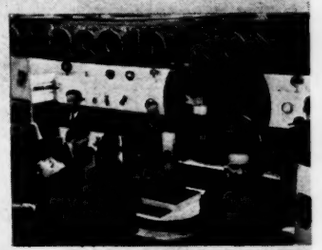


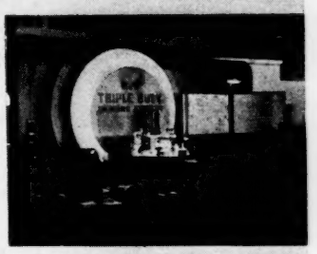


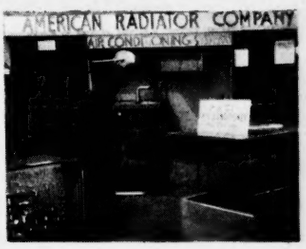
AT THE CHICAGO SHOW

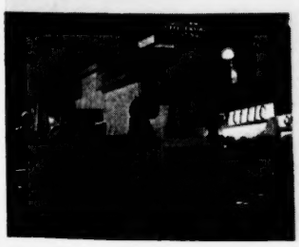


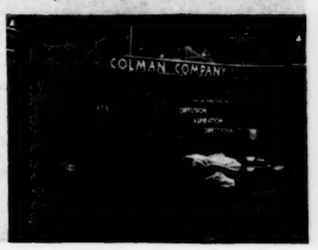
Fourth International Heating & Ventilating • • Exposition • • January 27-31, 1936. A few of the more than three hundred exhibits at the most successful of the industry's shows yet held • • Attendance totaled 44,695

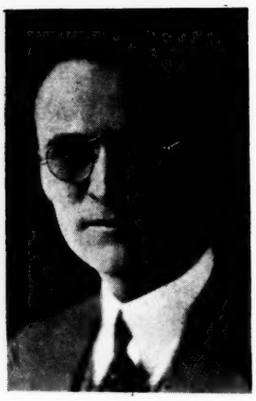












Oil Burner Institute's President W. J. Smith

Integrating an Industry

is the aim of Oil Burner Institute, whose activities include promoting oil burner sales, working with burner makers and oil marketers, watching burner legislation, and putting on an exposition and convention

G. Harvey Porter, managing director of OBI

FOLLOWING nine months of intensive effort in reorganization of the activities of the old AOBA, the Oil Burner Institute is rapidly completing plans for the 12th Annual Convention and National Oil Burner Show which will be held in Detroit April 14-18. One hundred and sixteen booths have been taken by 63 exhibitors (as of February 19), and the remaining 20% of space is rapidly being sold.[1]

While plans for the convention program are still tentative it has been announced that there will be a merchandising session on Thursday, April 16. This will be "dealer day" and discussions will be held by authoritative speakers on such subjects as market analysis, salesmanship, and financing. It is believed that these three subjects comprise the entire essence of marketing oil burner appliances. D. G Valentine, merchandising manager for N. W. Ayer and Sons, has been selected to speak on market analysis; other speakers have not yet been announced. G. Harvey Porter, managing director of the Institute, will be chairman of the merchandising session.

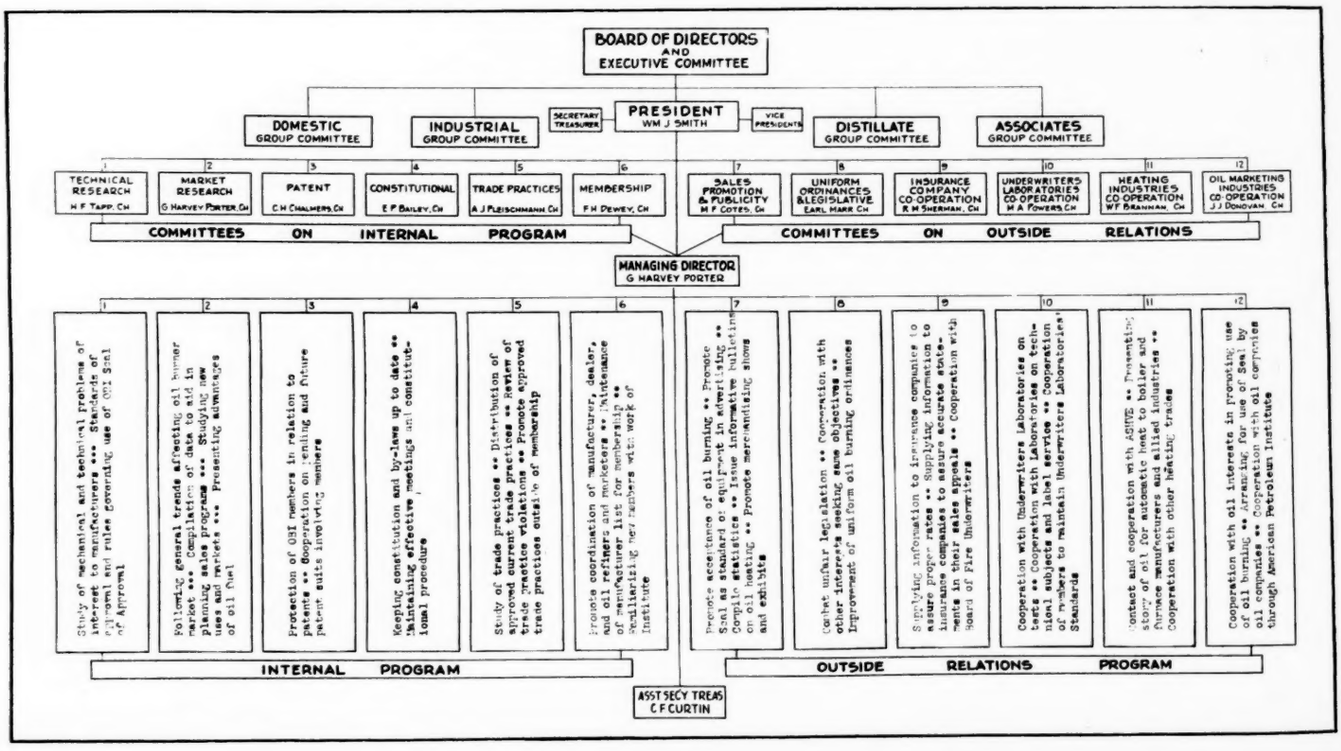
The annual meeting of the Institute will be held April 17 and the same day the Board of Directors will select officers for the ensuing year. In the evening will be held the Institute's annual banquet and dance, at which R. S. Bohn will be toastmaster. Altogether the show promises to be the largest in the history of the Institute as well as the most representative of all of the elements comprising the oil burning industry.

[1]Exhibits are available to firms whether or not they are members of the Institute, excepting burner manufacturers, who must be members to exhibit.

Institute Activities

Oil Burner Institute was organized in 1923 as American Oil Burner Association for the purpose, as stated in its charter, to foster the interests of the oil burner industry. Its membership comprises manufacturers of oil burners and of oil burner accessories. The Association was reorganized last July and its name changed to Oil Burner Institute at which time the directors selected Mr. Porter as managing director and charged him with the task of augmenting the national market for oil burning appliances. The Institute is governed by a Board of Directors and Executive Committee, with W. J. Smith, Cleveland Steel Products Corporation, as its president. There are 12 active committees working on the many problems of the industry, as shown on the chart of organization which explains graphically how OBI functions.

The Institute believes that the rate of acceptance by the public of oil fuel can be doubled by concerted action on the part of all interests in the industry. One method it has adopted for


BOARD OF DIRECTORS AND EXECUTIVE COMMITTEE
DOMESTIC GROUP COMMITTEE
INDUSTRIAL GROUP COMMITTEE
SECRETARY TREASURER
PRESIDENT WM J SMITH
VICE PRESIDENTS
DISTILLATE GROUP COMMITTEE
ASSOCIATES GROUP COMMITTEE
1 TECHNICAL RESEARCH H F TAPP, CH
2 MARKET RESEARCH G HARVEY PORTER, CH
3 PATENT C H CHALMERS, CH
4 CONSTITUTIONAL E P BAILEY, CH
5 TRADE PRACTICES A J FLEISCHMANN, CH
6 MEMBERSHIP F H DEWEY, CH
7 SALES PROMOTION & PUBLICITY M F COYES, CH
8 UNIFORM ORDINANCES & LEGISLATIVE EARL MARR, CH
9 INSURANCE COMPANY CO-OPERATION R M SHERMAN, CH
10 UNDERWRITERS LABORATORIES CO-OPERATION W A POWERS, CH
11 HEATING INDUSTRIES CO-OPERATION W F BRANNAN, CH
12 OIL MARKETING INDUSTRIES CO-OPERATION J J DONOVAN, CH
COMMITTEES ON INTERNAL PROGRAM
COMMITTEES ON OUTSIDE RELATIONS
MANAGING DIRECTOR G HARVEY PORTER
1 Study of mechanical and technical problems of interest to manufacturers •• Standard of approval and rules governing use of OBI Seal of Approval
2 Following general trends affecting oil burner market •• Compilation of data to aid in planning sales programs ••• Studying new uses and markets ••• Presenting advantages of oil fuel
3 Protection of OBI members in relation to patents •• Cooperation on pending and future patent suits involving members
4 Keeping constitution and by-laws up to date •• Maintaining effective meetings and constitutional procedure
5 Study of trade practices •• Distribution of approved current trade practices •• Review of trade practice violations •• Promote approved trade practices outside of membership
6 Promote coordination of manufacturer, dealer, and oil refiners and marketers •• Maintenance of manufacturer list for membership •• Peddlerizing new members with work of Institute
7 Promote acceptance of oil burning •• Promote Seal as standard of equipment in advertising •• Compile statistics •• Issue informative bulletins on oil heating •• Promote merchandising shows and exhibits
8 Combat unfair legislation •• Cooperation with other interests seeking same objectives •• Improvement of uniform oil burning ordinances
9 Supplying information to insurance companies to assure proper rates •• Supplying information to insurance companies to assure accurate statements in their sales appeals •• Cooperation with Board of Fire Underwriters
10 Cooperation with Underwriters Laboratories on tests •• Cooperation with Laboratories on technical subjects and label service •• Cooperation of members to maintain Underwriters Laboratories Standards
11 Contact and cooperation with ASHVE •• Presenting story of oil burners to boiler and furnace manufacturers and allied industries •• Cooperation with other heating trades
12 Cooperation with oil interests in promoting use of oil burning •• Arranging for use of Seal by oil companies •• Cooperation in oil companies through American Petroleum Institute
INTERNAL PROGRAM
OUTSIDE RELATIONS PROGRAM
ASST SECY TREAS C F CURTIN

achieving its objective is the use of the OBI Seal of Approval on the oil burners manufactured by its members. For the consumer, this seal is intended to be the symbol of a responsible product manufactured by a responsible company and installed by a responsible dealer.

Accomplishments

Progress has been made by OBI in a number of ways. In a statement made by Mr. Porter late in February he said, "I have been authorized to say that a special committee of American Petroleum Institute has been formed for the express purpose of surveying common industry problems, with a similar special committee of Oil Burner Institute." This bare statement of fact does not reveal the work done by OBI and various members of API's staff in preparing the way for the formation of the committee or of the necessity for the existence of such a committee.

Along other lines, OBI already has a sizable accomplishment to its credit. It is maintaining activity in legislative watchfulness in the interests of the oil burner industry, and in this connection tackled the New York City situation. For the past few years rules governing oil burner installations in New York have been confusing and onerous to the industry because of the question of dual jurisdiction, following the passage of the McCall bill in 1933. OBI's legislative committee, of which Earl Marr is chairman, took an active part in bringing about remedial legislation with the result that the Mandelbaum bill was signed late in February by Governor Lehman, placing definite responsibility with the Fire Department for the carrying out of these duties.

Of the committees shown on the organization chart, a number deserve special attention. The committee on technical research is so set up that it can be temporarily broadened to study any mechanical or technical problems of interest to oil burner manufacturers, even though the Institute has no laboratory facilities for research at the present time. A special study is under way by the committee on market research concerning the general economic trends affecting the oil burner market. This committee is available for special problems submitted to it by oil burner manufacturers. The subject of trade practices is under active review by the committee dealing with these matters and a new plan of administration was suggested to the board of directors recently and is now under review.

Membership

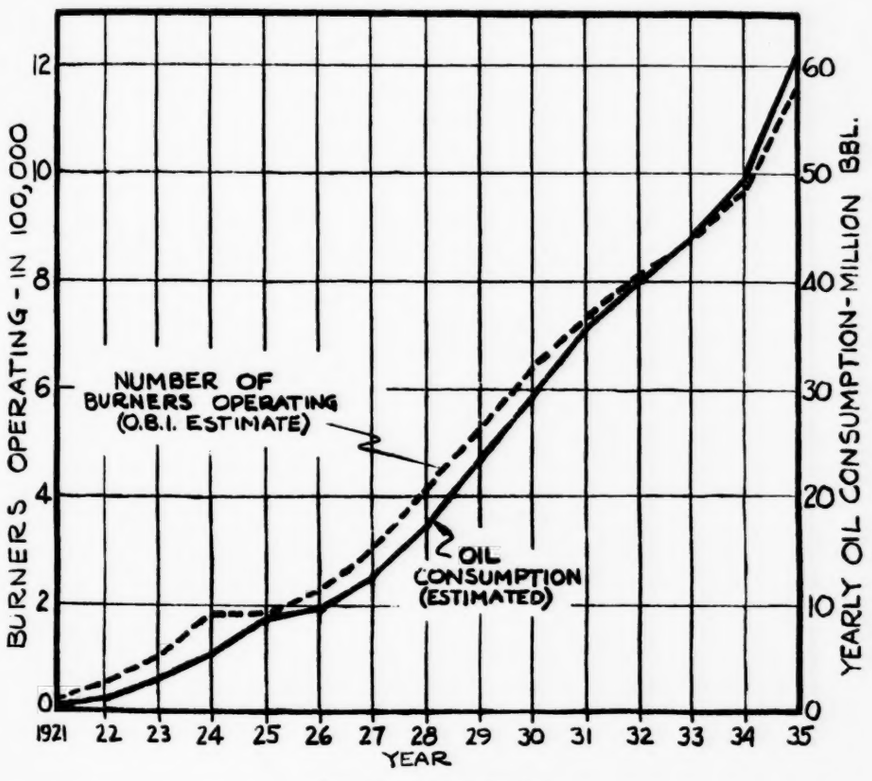
OBI now has 48 members, as follows (those marked * will exhibit at the Detroit show):

Alasco Burner Co., Inc.; American Radiator Co.*; Anchor Post Fence Co.*; Automatic Burner Corp.*; Bethlehem Foundry & Machine Co.*; Caloroil Burner Corp.; Campbell Machine Co.; Carter-Korth Oil Burner Corp.; Chalmers Oil Burner Co.; Cleveland Steel Products Corp.*; Delco Appliance Corp.; Eddington Metal Specialty Co.; Fitzgibbons Boiler Co., Inc.*; Franklin Oil Heating, Inc.; Gar Wood Industries, Inc.*; General Electric Co.*; Gilbert & Barker Mfg. Co.*; The Goodrich Oil Burner Mfg. Corp.; Harvey-Whipple, Inc.; Jefferson Electric Co*; Kelvinator Sales Corp.; Kleen Heat, Inc.*; Lynn Products Co.; Malleable Iron Fittings Co.; May Oil Burner Corp.*; McDonnell & Miller*; Mercoid Corp.*; The Micro Corp.; Minneapolis-Honeywell Regulator Co.*; Motor Wheel Corp.*; McIlvaine Burner Corp.; National Airoil Burner Co.; Norge Corp.; Nu-Way Corp.*; The Ohio Electric Mfg. Co.; Oil Burner Builders, Inc.*; Penn Electric Switch Co.*; Petroleum Heat & Power Co.*; Pierce Burner Corp.; Preferred Utilities Mfg. Corp.*; Reif Rexoil, Inc.*; Silent Glow Oil Burner Corp.; Taco Heaters, Inc.*; H. A. Thrush & Co.*; Timken Silent Automatic Co.*; Tuthill Pump Co.*; Wayne Oil Burner Co., Inc.*; and York Oil Burner Co., Inc.*

Others exhibiting, not members of the Institute, are:

Adams Engineering Co.; American Brass Co.; Automatic Heat & Air Conditioning; Bell & Gossett Co.; Century Electric Co.; Century Engineering Corp.; Detroit Fuel Oil Ass'n.; Detroit Lubricator Co.; Dongan Electric Co.; Electrol, Inc.; Excelso Products Corp.; Fluid Meters Co.; Fuel Oil Journal; Gould Oil Burner Co.; Hoffman Specialty Co.; Hotstream Heater Co.; International Heater Co.; The Kent Co.; Kewanee Boiler Corp.; H. C. Little Co.; Monarch Manufacturing Works; National Radiator Corp.; Oil Burner Institute; Oil Heat; Perfex Controls Co.; Plumbing & Heating Trade Journal; Refractory & Engineering Corp.; Scully Signal Co.; Standard Oil Co. (Indiana); Sundstrand Machine Co.; Syncro Flame Burner Corp.; Titusville Iron Works Co.; Waterfilm Boiler Co. Inc.; Westinghouse Electric & Mfg. Co.; Whitehall Equipment Co., Webster Electric Co.

OBI Seal of Approval



Growth of an Industry

Growth of the domestic market for oil burners has been constant since this equipment was first marketed. The number of oil burners operating in 1921 was estimated to be 12,500 of which not more than 5,000 were of the mechanical draft type. Today domestic burners total 1,100,000 of which the mechanical draft type exceed 900,000. Banner year of the industry was 1935 when sales increased so rapidly as to excite the attention of other industries. Parallel to this growth is the increased consumption of fuel oil for domestic heating which has jumped from 600,000 bbl. in 1921 to more than 61 million bbl. in 1935.

Comfort Standards and Fuel Saving Methods Feature 42nd Meeting of ASHVE

ALL records for attendance at ASHVE meetings were broken at the 42nd annual meeting held at the Palmer House, Chicago, January 27-30. The attendance totalled 1,265, a hundred more than that of the Philadelphia meeting of 1930, which was the previous high. Improvements in business conditions, the attraction of the 4th International Heating and Ventilating Exposition held the same week at the Stockyard Amphitheatre, and the fact that the National Warm Air Heating and Air Conditioning Association was holding its annual meeting during the same week, all contributed to the attendance, enthusiasm and general interest displayed.

The first technical paper to be presented was that of the Tuesday morning session, January 28, and entitled "Thermal Properties of Concrete Construction," by Prof. F. B. Rowley, Prof. A. B. Algren, and Clifford Carlson, all of the University of Minnesota. A review of this paper appeared on these pages in last month's issue.

"Comparative Study of Combustion Results with Various Thermostats" was the subject of a paper by Burton E. Shaw, research chief of Penn Electric Switch Company. The study was concerned with thermostats employing artificial heating within the thermostat itself, the object of the paper being to correlate results on the various thermostats to compare the effect of thermostat design, operation, and location on various factors affecting flue gas loss, oil consumption, off-period stack loss, and physiological comfort, and the effect on oil consumption of lowering the thermostat setting at night.

In these tests, thermostats having a setting such that the room temperature variation at the thermostat was less than 1° were termed short cycling thermostats. A thermostat set so that it resulted in a 1° to 2° maximum variation was called a medium cycling thermostat, while those operating to maintain a maximum variation of more than 2° were designated as long cycling thermostats.

Short cycling resulted in line temperature control with normal variations less than ¼° at the thermostat location, while the medium cycling devices resulted in normal variations which, being less than 1°, were termed close temperature control. The authors found that there was practically no difference between the economy of close temperature control and that obtainable with conventional or wide temperature operations, but that from the standpoint of comfort line or close temperature control was more desirable than that obtained with conventional thermostats. Other conclusions relating to the cycling included the following: The average flue loss for short cycle operation was less than medium cycle operation, which was less than long cycle operation. The average off-period loss for short cycle operation was greater than that for medium cycle operation which was slightly greater than that for long cycle operation.

Perhaps the most important conclusion to be drawn from this investigation relates to the inherent advantages of short as compared to long cycle operation. The tests indicated that short and medium cycling resulted in greater room comfort conditions. Also because of lower flue gas losses, short cycle operation would give the ultimate in economy of operation if present designs permitted more complete control of off-period losses. Medium cycling (close temperature control within about 1° room temperature variation) will result in but very little increased oil consumption and yet affords the maximum possible in room comfort.

Prof. A. P. Kratz and S. Konzo, of the University of Illinois, presented a paper on "Fuel Saving Resulting from the Use of Storm Windows and Doors." This paper was also reviewed in the February issue, page 65.

At the Wednesday morning session, Prof. G. L. Tuve, Case School of Applied Science, presented a paper which was the result of research between the Society and Case on "Performance of Fintube Units for Air Heating, Cooling and Dehumidifying." This paper is the second presented on this subject by the author and is, in a sense, a progress report. The tests indicated that reasonably accurate performance tables may be built on the basis of a few simple straight line graphs of overall heat transfer coefficient plotted against air velocity. For rapid approximate calculations, the capacity of heating or dry cooling coils may be assumed to vary directly as the square root of the air velocity.

The author suggested that for maximum heat transfer, the fintubes should be placed as close together as possible without interlocking, arranged in staggered rows, and provided with a turbulence grid in front of the section to increase the effectiveness of the first row of tubes. The author pointed out that more study and research is necessary, especially in the field of dehumidification, in order to establish a satisfactory basis for uniform methods of rating these units. He mentioned that accurate knowledge of surface coefficients for the fluids inside the tubes is still lacking.

Ions Affect Comfort

Studies of the importance of ionization are still under way and an additional paper on this general subject was presented by Doctors C.-E. A. Winslow and L. P. Herrington, director and assistant director, respectively, of the John B. Pierce Laboratory of Hygiene at Yale University. The paper, entitled "Subjective Reactions of Human Beings To Certain Outdoor Atmospheric Conditions," was undertaken primarily in an attempt to discover whether any subtle and hitherto unrecognized climatic factors might exert some effect upon human reactions as to the relative pleasantness of the outdoor air.

In studies made with a group of 80 subjects, it was found that judgment of the subjects with regard to the pleasantness of outdoor air (with tests taken each morning for a year) is chiefly influenced by sunshine, next by relative humidity, and third by ions. The pleasantness was a positive one with sunshine, but an inverse relationship existed between this feeling and the relative humidity and ionic content. The influence of ions is not related to electrical charge, since positive and negative ions show identical results. The authors are inclined to explain it as the result of the effect of those gaseous products of combustion (in houses and automobiles) which make up a large proportion of the ions in a city environment.

A paper on "Ventilation Requirements" by Prof. C. P. Yaglou, E. C. Riley, and D. I. Coggins was presented. This paper, rearranged and abstracted, appears on page 31 of this issue.

W. A. Rowe, mechanical engineer, presented a paper entitled "Airfoil Fan Characteristics," a study of propeller fans. Mr. Rowe's conclusions follow:

The ordinary airplane propeller is inherently unsuited for use as an efficient ventilating fan without modification of either its form of blade tip, or the orifice ring, or both.

The contraction of the air stream increases the velocity head loss. Increasing the coefficient of area of the air stream raises the mechanical efficiency.

Streamline orifices, more effective forms of blade tips, and a greater number of blades all tend to increase the efficiency.

The use of a short discharge duct eliminates swirl at blade tips, recovers some velocity head, and increases the capacity and the mechanical efficiency.

Variable blade pitch is better than constant pitch and moderate pitch ratios of 0.75 are the optimum.

An increase in the number of blades increases the capacity as the fourth root of the number ratio, the static pressure more nearly in direct proportion to the number, and the mechanical efficiency slightly.

With airfoil blades high mechanical efficiencies may be realized and especially in the region of free delivery where the majority of these fans operate.

Fans with airfoil blades have non-overloading horsepower characteristics except with multi-blades having pitch ratios above the optimum.

Airfoil fans conform to fan laws, in relation to capacity, pressure, and horsepower when the speed, air density, or size is changed. As the great majority of these fans operate at, or near, free delivery, and are frequently only so rated, these fan laws are very helpful in calculations concerned with the selection and application of fans.

Wednesday afternoon a joint session was held with the NWAHACA at the Stevens Hotel. A report of this session appears in connection with the report of the NWAHACA on page 50.

Comfort Standards

At the Thursday morning session F. C. Houghten, director of the ASHVE Laboratory, and Carl Gutberlet, also of the Laboratory, presented a report on "Comfort Standards for Summer Air Conditioning." It has been found that use of the summer and winter comfort zones in connection with air conditioning did not apply universally and that some consideration should be given to the temperature of the outside air. This belief has been built up due to complaints at box offices of theaters, and there has been developed a variable indoor summer cooling standard based on the outdoor dry bulb temperature which has been used as a standard since 1933. This standard allows only a single definite moisture content or dewpoint temperature of the air, regardless of outside conditions, and a definite indoor dry bulb temperature for any given dry bulb temperature outside. Attempts to apply this standard in practice for different air conditioning applications and with different types of equipment have resulted in considerable chaos and dissatisfaction, resulting in the resubmission of the study of the Society's research laboratory.

The study indicates rather conclusively that the average person will become comfortable within from 20 to 40 min. after entering any atmospheric condition within an effective temperature range of 70° or 71° to 74° or 75°. Within this range no appreciable variation was observed in the magnitude or the duration of the cooling shock with either the relative humidity of the cooled condition or the severity of the previous condition. Also, little variation in the rate of disappearance of sensible perspiration was observed for relative humidities up to 65%; for relative humidities as high as 85% there seem to be some increase in the length of time necessary for the complete disappearance of sensible perspiration.

Social Activities

The annual banquet and dance held in the grand ballroom of the Palmer House was, like the meeting, the largest ever held by the Society. Retiring President John Howatt broadcast over the NBC network at the opening of the banquet. This was followed by the presentation of the F. Paul Anderson Medal to Dr. Arthur Cutts Willard, past president of the Society and now president of the University of Illinois. Following an acceptance speech by Doctor Willard, he was also presented with a combination desk barometer and thermometer by H. T. Richardson, president of the NWAHACA as indication of appreciation of the work Doctor Willard has done in connection with the cooperative research carried on over the last 20 years at Illinois by the University and the NWAHACA. Mr. Howatt was then presented with a past president's emblem by Samuel R. Lewis who was followed by the speaker of the evening, Maj. John L. Griffith, athletic director of the Big Ten. Oliver J. Prentice, C. A. Dunham Company, was toastmaster.

Trips

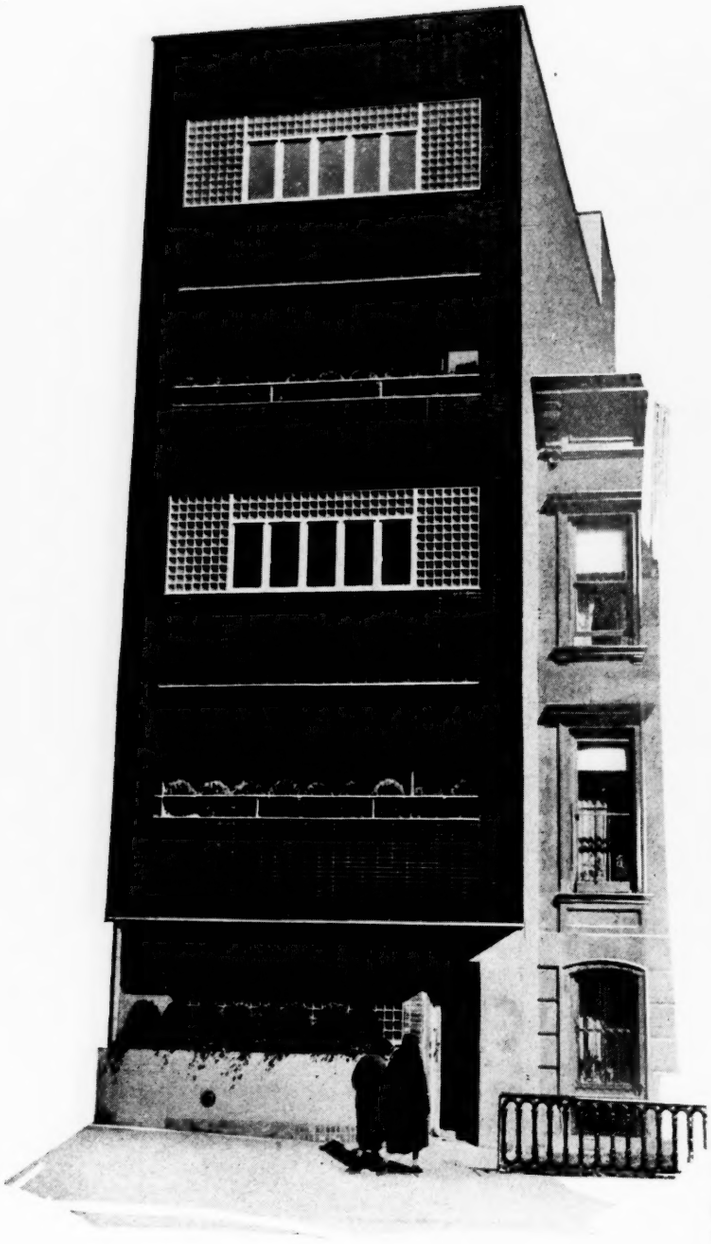
Friday morning the Crane Company arranged an inspection of its laboratories and Corwith Plant which was attended by 200. Special guides conducted the visitors through the various manufacturing processes from the receiving of raw materials to the finished product packed ready for shipment. At noon lunch was served in one of the large plant dining rooms. During that hour, Charles B. Nolte, president of Crane Company, was introduced to the guests, and extended to them a cordial and official welcome. Others to be introduced included J. H. Collier, vice-president, manufacturing division; P. R. Mork, vice-president, sales division; John Howatt, engineer, Chicago School Board, and Prof. G. L. Larson.

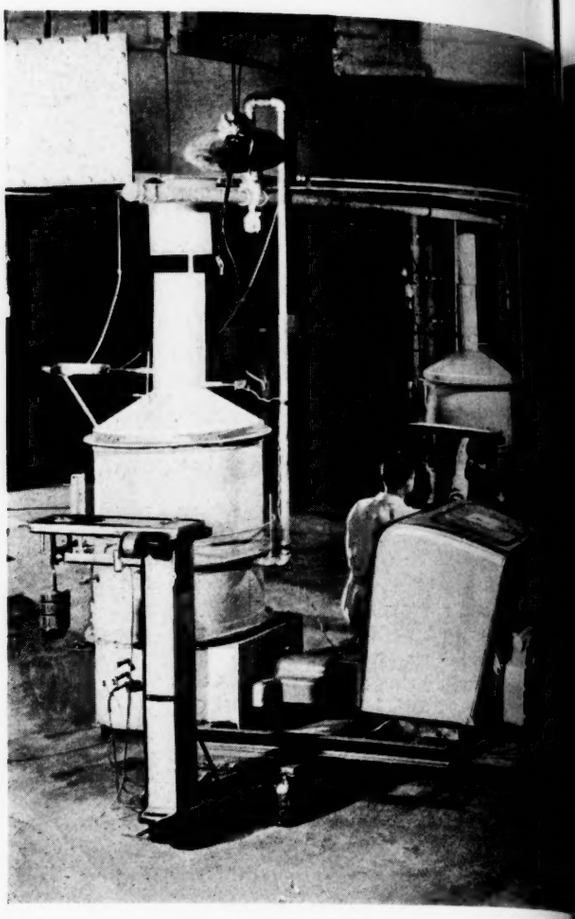
A similar trip was also made to the plant of the Ilg Electric Ventilating Company.

New Officers

Prof. G. L. Larson, University of Wisconsin, was elected president of the Society. D. S. Boyden, Edison Electric Illuminating Co. of Boston, and E. H. Gurney, Toronto, were elected first and second vice-presidents, respectively. A. J. Offner, New York, was re-elected treasurer.

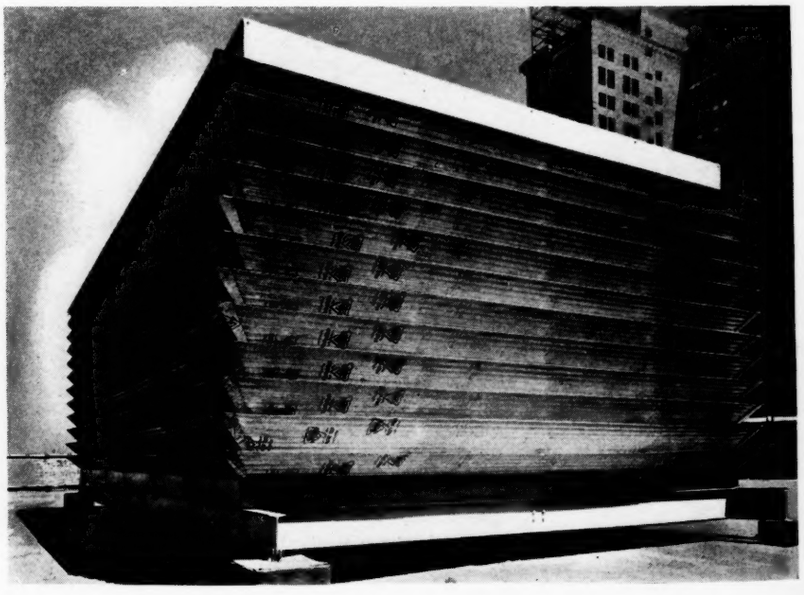
A few of the ASHVE members and guests at the Crane Company's plant, Chicago, during a visit to this company's Corwith Works.



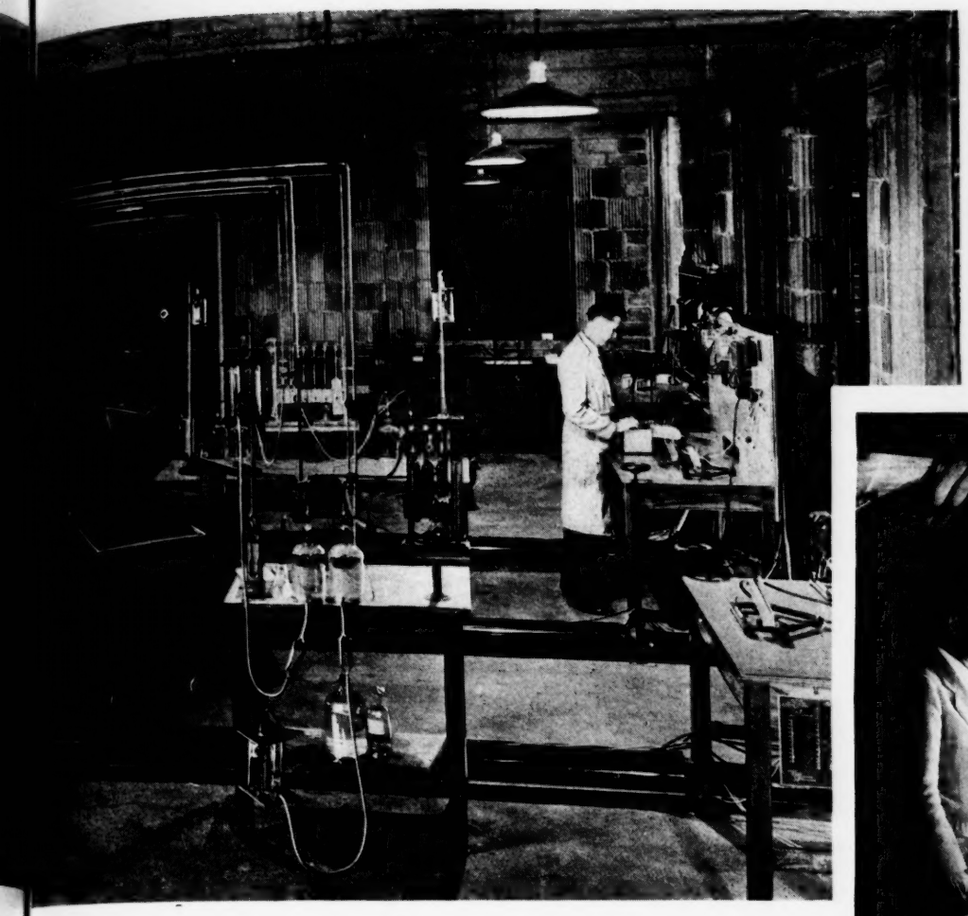


PICTURE

GLASS BRICK WALL apartment house, 219 East 49 St., New York, has year 'round air conditioning. (Left). Eadie, Freund & Campbell were the consulting engineers and the conditioning equipment was installed by Schwerin Air Conditioning Corporation.

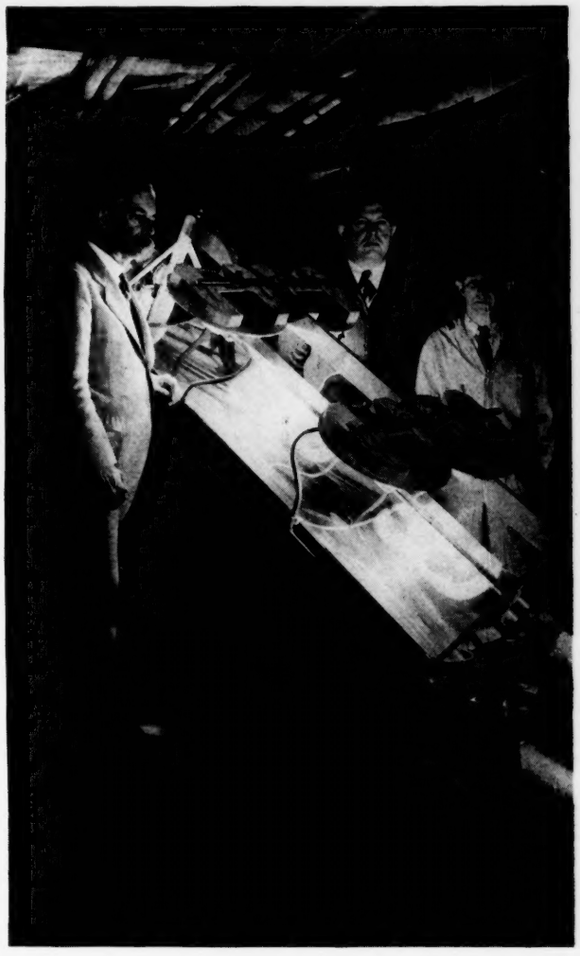


2½ TONS OF ARMCO INGOT iron were used in constructing the louvers and framework of this atmospheric spray tower, designed and installed by the Refrigerating & Atmospheric Correction Company for the Allen Theater, Cleveland. The tower cools 900 g.p.m. of water to within 5° of the wet bulb temperature of the air.



HEATING WITH STOKERS using soft coal is being studied by Battelle Memorial Institute, one of whose laboratories is illustrated here. (Left). The program is being sponsored by Bituminous Coal Research, Inc.

HEATING WITH THE SUN is being studied by Smithsonian Institution under the direction of Dr. C. G. Abbot. (Below). A parabolic cylindrical mirror of aluminum is used. Solar heat is absorbed by a chlorinated diphenyl compound blackened with lamp black. The device has an overall efficiency of 15% for steam power production. (See also page 39)



PARAGRAPHS

HEAT TRANSMISSION is being studied in this building. (Left). The Texas Engineering Experiment Station of Agricultural and Mechanical College of Texas. The study, a cooperative one between the ASHVE and the College, is in charge of Dr. F. E. Giesecke. The tower of the building houses the expansion tank for the central hot water heating system for the College buildings.

Fig. 1. Steel frame house, one of those being erected at Purdue.

Purdue Tackles the Housing Problem,

builds houses for testing, proposes erection of laboratory in which houses can be subjected to rapid weathering

NINE houses under construction in Lafayette, Ind., will soon be completed, making the first important step in the activities of the Purdue University Housing Research Project. The purpose of the project which is under the direction of the Purdue Research Foundation, is to provide a study and actual demonstration of the modern home in all its phases. The project will be a form of living testing laboratory to serve the same function for the building industry as engineering experiment stations have for other industries.

Land for the development has been donated by David E. Ross, a Purdue alumnus, and totals 145 acres. It is upon this site that the Research Foundation is building the nine homes, five of which are almost completed. They will be occupied by members of the staff at the University who will pay a minimum rental. Through arrangements with these men, data of almost every kind including fuel costs, performance of mechanical equipment, structural soundness, maintenance cost, insulating value, and air conditioning performance will be collected.

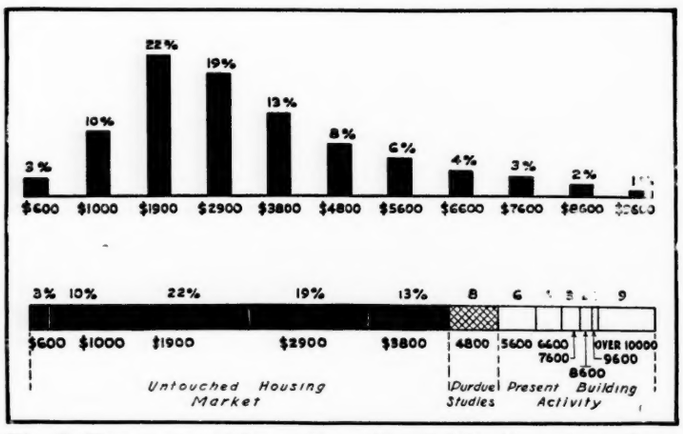
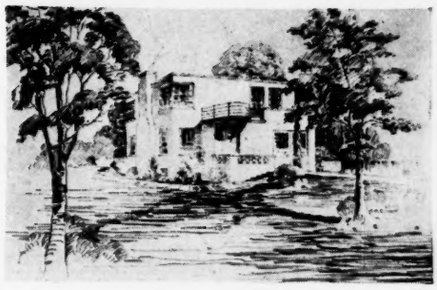


Fig. 2. Upper row of bars shows the distribution of numbers of families by annual income; the bar below, the cost of houses their incomes will support. Note range of Purdue studies.

According to the Foundation, present building activity in homes is largely in the range of those costing over $5,500. The Purdue studies (see the accompanying graph) will cover houses in the range from about $4,500 to $5,000, although admittedly these houses are too expensive for 75% of American families. It is recognized that this requirement does not fit the mass of prospective homeowners and that the general income level of the country will not support an extensive housing development in the $5,000 price class. Preliminary studies reveal, however, that it is all but impossible in the present state of the art to erect well built, satisfactory and salable houses, at a much lower figure even with the relatively high range of cost of houses being studied at Purdue. For instance, it has been generally necessary to eliminate dining rooms, and motor-driven oil burners and automatic stokers could not be included. Those in charge of the project, however, were of the opinion that no compromises in the basic soundness of construction should be made in favor of such items of mechanical equipment.



A few of the other houses being built for the project. Fig. 3(left) House No. 1, which won an architectural prize; Fig. 4 (center) House No. 5, the only radiator-heated house in the group; Fig. 5 (right) House No. 3, with concrete walls.

Of the five homes started first, four are heated by warm air and one by a pipe gravity steam system.

The building of test homes, which ultimately are expected to number about twenty-five, is only part of the program of the Foundation. Plans are under way for the erection of an All-Weather Laboratory which will be large enough to hold an entire house in which all kinds of weather can be reproduced so that in the course of a few months a house may experience the weather it would usually encounter in the course of 20 years. This laboratory will be a nucleus around which the other activities of the Foundation will be organized.

Frank Watson, director, Housing Research Project.

What the Houses Are Like

One of the first houses to be completed, one that was awarded first prize in a small home competition conducted by the New York chapter of the American Institute of Architects, was designed by J. Andre Fouilhoux, New York. This house, heated by a flash type oil burner and a forced warm air system, has frame walls, mineral wool insulation and cement stucco on paper backed metal lath.

House number two, a prefabricated structure, is the result of study and research on the part of Howard T. Fisher and John A. Pruyn. This building, shown in Fig. 1, has a 16-gage copper-bearing steel frame, wall panels built up of asbestos cement board, fir plywood and two sheets of aluminum foil. The heating will be by an automatic oil burner in a forced warm air system.

The reinforced concrete house selected for the project was designed by Burnham Brothers & Hammond, Inc., Chicago. Illustrated in Fig. 5, this house is heated by a hand fired gravity warm air furnace.

Another Chicago architectural firm, McNally & Quinn, has contributed its skill in the design of a house being built almost entirely of wood (See Fig. 4). This is the only building heated by radiator heat, and has a coal boiler serving a one pipe steam system.

A fifth house, designed by Insulated Steel Construction Company, has frameless steel walls and a cellular steel roof. It is heated by a gas-fired forced warm air furnace.

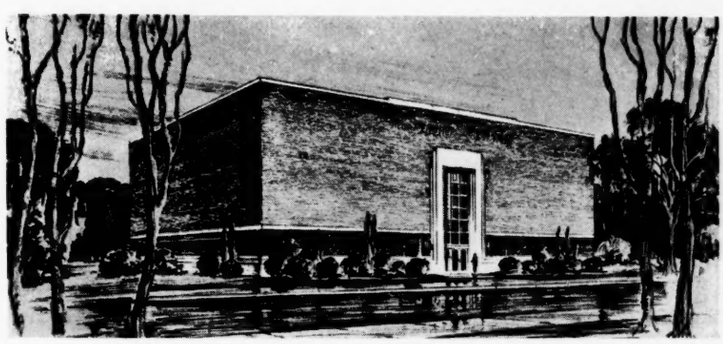


Fig. 6. The All-Weather Laboratory inside which houses will be built and subjected to artificial weathering.

Aims of the Program

The purposes of the Purdue projects give an adequate idea of the nature of the program contemplated. Among these purposes are the following:

To provide research facilities for homes as a whole more complete in scope than any existing agency in the building field.

To conduct research and testing on a strictly independent basis — functioning always as a non-commercial agency whose findings may be accepted by all as being entirely free from bias.

To conduct all research work with a view of issuing reports of findings which are more truly indicative of the actual performance of building structures than has generally been true of the more limited material-testing in the past, and to state results of findings insofar as possible in terms which will be equally understandable to laymen and professional men.

To pursue research and testing closely in cooperation with other existing laboratories and to invite their participation in the conduct of test programs where the Purdue programs have a natural bearing upon the specialized programs of other organizations.

To give particular attention to the organization of research and testing procedure for the purpose of aiding in the broadening of building codes and regulations, and the bettering of standards acceptable to loan agencies.

To act as an instrument for carrying out definite research projects for industrial concerns or others—either for the development of new processes or for the verification and testing of new systems of materials.

To undertake a program of the compilation of the best, most authoritative and most modern scientific data on tests and performance of building products and structures (from all existing sources) and to promote a program of intelligent coordination of all existing testing and research agencies.

Warm Air Group Meets in Chicago, Hears Technical Papers

THE 23rd annual convention of the National Warm Air Heating and Air Conditioning Association held at the Stevens Hotel, Chicago, January 29-30, was the most successful held in the history of the Association. One of the sessions was a joint one with the ASHVE which held its meeting in Chicago during the same week. An additional feature which undoubtedly brought many of those attending to the city was the 4th International Heating and Ventilating Exposition.

The convention opened the morning of January 29 with a message from President H. T. Richardson who stressed the need for aggressive salesmanship, especially in view of the entrance into the warm air field of mass production manufacturers who sell to franchised agents rather than to the trade. He called the attention of the meeting to the organized competition of the radiator heating industry in Chicago and admonished the manufacturers and dealers to take a greater advantage of FHA activities than they did in 1935.

Former Governor A. O. Eberhart of Minnesota, who addressed the convention at Pittsburgh last year, again was on the program. He urged members to write their congressmen for the extension of FHA beyond April 1, 1936 and pointed out that if FHA has done nothing else, it has cleared up the mortgage situation, and reminded his audience that in the future, homeowners can expect single term mortgages for the duration of the time required for them to pay out.

Prof. J. D. Hoffman, of Purdue University, presented a paper on "Insulation—Why and How," which will be abstracted in next month's issue.

H. B. Johns, manager of the house heating division, Peoples Gas, Light and Coke Company, Chicago, presented a paper on the application of gas to warm air heating systems. The speaker praised the Association's standard code for gravity and mechanical systems, and declared that the gas companies follow these two codes in determining whether a warm air system is correctly installed. He said that typical costs per season for gas heating in the Chicago area were $25 per room at a gas rate of 7 cents per therm or 20 cents per square inch of first floor leader pipe, 30 cents per square inch of second floor leader pipe, and 35 cents per square inch of third floor leader pipe. Mr. Johns also discussed in detail the use and application of drafthoods.

Wednesday afternoon, Janury 29, a joint session was held with the ASHVE in the North Ballroom of the Stevens Hotel. At this meeting, John Howatt, retiring president of the ASHVE, and President Richardson of the NWAHACA, acted as joint chairmen.

W. C. Randall presented a paper prepared by him and Prof. J. M. Emswiler, University of Michigan, on "Room Surface Temperature of Glass in Windows." Among their conclusions were those relating to the conditions under which moisture will be deposited on the inside of windows. For single windows and with a 30% relative humidity inside, moisture will be condensed on the glass at an outside temperature of 22°; for double windows this will occur at 0° and 45% relative humidity. An increase in the relative humidity of 1% increases the outside temperature at which moisture will form on windows by 2°.

Further conclusions indicated that there is little difference in the room surface temperature of single glass in steel and wood windows, but there is a difference in the case of double windows, probably accounted for by the difference in the air space between the glass.

Prof. A. B. Kratz, University of Illinois, outlined the cooperative efforts of the ASHVE with various universities which include: standards for summer cooling; corrosion of air conditioning equipment; frictional resistance of air in small ducts; heat requirements of buildings; dust and air cleaning devices, and treatment of diseases in conditioned rooms.

F. G. Sedgwick, Waterman-Waterbury Company, and chairman of the Research Advisory Committee of the NWAHACA, reviewed the activities of the Association in connection with research.

W. L. Rybolt, newly elected president, NWAHACA.

S. Konzo, special research associate at the University of Illinois, presented a progress report on "Residence Cooling Using Water from City Service Mains." This report is not, at the present time, ready for publication.

L. R. Taylor, vice-president, International Heater Company, spoke on "Merchandising in Our Industry," opening the Thursday morning session. In Mr. Taylor's opinion, canvassing is not a profitable activity for every contractor, but it can be a profitable part of an intelligently planned sales campaign, and one-twelfth of his working time can be well devoted by any contractor to sales and canvassing. He suggested cooperation with oil burner dealers and others dealing with mechanical equipment of buildings in a plan whereby one salesman is hired by the group. He gave five requirements for successful merchandising as follows: (1) knowledge of the product and of the craft, (2) use of display rooms and advertising, (3) determination of the salable market, (4) sales campaigns, (5) allotment of a definite sum for advertising and sales expense.

Ralph A. Sherman, of Battelle Memorial Institute, described the "Bituminous Coal Industry's Program of Research in Domestic Heating." Mr. Sherman's paper will be abstracted in next month's issue.

Platte Overton, consulting engineer, presented a paper on "The Combination Cooling & Heating System."

W. L. Rybolt, Rybolt Heater Company, was elected president of the association succeeding H. T. Richardson. L. R. Taylor, International Heater Company, and Dana W. Morris, Lennox Furnace Company, were elected first and second vice-presidents, respectively. New directors elected are: C. A. Olsen, Fox Furnace Co., Elyria, Ohio; Richard M. Judd, Premier Furnace Co., Dowagiac, Mich.; H. S. Sharp, Henry Furnace & Foundry Co., Cleveland; H. P. Mueller, L. J. Mueller Furnace Co., Milwaukee; Shirley Percival, Green Foundry & Furnace Co., Des Moines, Ia.

Directors whose terms do not expire this year and who will continue are: F. E. Mehrings, Meyer Furnace Co., Peoria, Ill.; R. W. Blanchard, Hart & Cooley Mfg. Co., Chicago; D. M. Dobbins, Marshall Furnace Co., Marshall, Mich.

H. T. Richardson, as the retiring president, becomes an ex-officio member of the Board of Directors.

Automatic Controls for Winter Central Fan Systems

Diagrams Show Simple Arrangements at the Fan

AUTOMATIC control for central fan systems is obtained by making a suitable selection and combination of a relatively few kinds of equipment. In a previous article[1] wherein these several kinds of equipment were classified and defined, this fact was noted. In that same article it was suggested that automatic control of the operation of central fan systems for summer cooling and for both winter and summer use combined could be understood by proceeding from relatively simple arrangements used in strictly winter systems to the more complex arrangement of controls used where year 'round operating control is essential.

It is the intention to proceed with this general idea, but the present article illustrates by the use of diagrams simple combinations of equipment for securing automatic control of central fan installations used during the heating season only and not intended to accomplish any summer cooling. Later articles will contain similar illustrations showing arrangements for cooling installations and for year 'round air conditioning plants.

This article consequently does not aim at completeness either in the sense of covering the whole subject of automatic controls as applied to central fan systems or in the sense of illustrating every possible combination of automatic controls which may be used in winter plants. Rather the aim is to show only certain typical simple combinations and then to illustrate some of these simple combinations grouped together to produce a more complex control system.

What is Included

To get started systematically it is necessary to decide just what types of central fan winter installations we will consider as falling within our present scope.

As these winter plants have been in use for so long a period the various kinds are familiar and it takes but a moment to note that they are:

1. Plants for ventilation only—the traditional split system.

2. Plants for heating and ventilation, which for operating economy are usually so arranged that return or exhaust air may be recirculated by passing all or part of it through the fan again. There are two kinds of these plants, viz:

(a) those using more outside air as the heating load decreases, and

(b) those using fixed quantities of both outside and return air.

In connection with the split system it is well to keep in mind that its heating equipment at the fan is intended only to supply enough heat to permit the air to reach the ventilated space at some predetermined temperature, usually in the vicinity of 70°. Heating of all but the ventilation air is taken care of by some other means such as direct radiators.

Also for clearness note that in plants of the type of 2(a), if the outside air is cut off completely at the time of peak load (lowest outside temperature) the plant operates as a heating plant only and is not a ventilating plant at all at such times. In certain types of buildings complete recirculation is practiced but in others the equipment is so arranged that a certain set minimum quantity of outside air is used even during peak operation of the plant.

Form of the Diagrams

Attention is now directed to the form of the accompanying diagrams. All are alike in general arrangement with the idea of showing their relations and variations simply. None are to scale or do they show actual equipment. They do show the position and arrangement of parts relative to each other and relative to the fixed parts of the system such as the fan, outside air connection, heating coils and steam or water lines.

It will be noted that in all the diagrams an exhaust air duct is shown. This is purely diagrammatic for in some installations no exhaust duct is actually present. However in every case there is *some* means of exhausting air from the building in an amount equal to that brought in. In some winter split systems the exhaust is purely by gravity filtration, in others by gravity flues, and in others by a separate exhaust fan. In heating and ventilating systems where all or part of the fan supply air is obtained from inside the building there may or may not be an actual duct for getting this air back to the fan inlet, for it may be allowed to drift back by natural circulation instead of providing a duct to carry it. It should be understood therefore that the exhaust duct is put on the illustrations for diagrammatic completeness and as an aid to clarity of principle. A draw-through arrangement is also shown throughout even though the fan may be installed to blow through.

Recall too that in central fan systems the heating of the air may be accomplished either by passing the air over only one coil or by passing it successively over a series of coils. Common practice is to use a preheater coil to raise the temperature of the outside air above the freezing temperature in cold weather and then to use a heating coil to raise the temperature to that desired for delivery into the ducts. For the sake of uniformity both a heating coil and a preheating coil are shown in the diagrams even though the particular con-

[1] See HEATING & VENTILATING, February, 1936, pages 21-24.

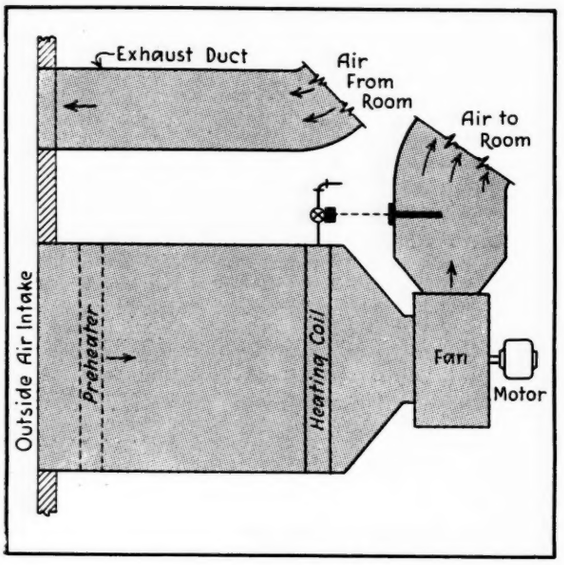


Fig. 1

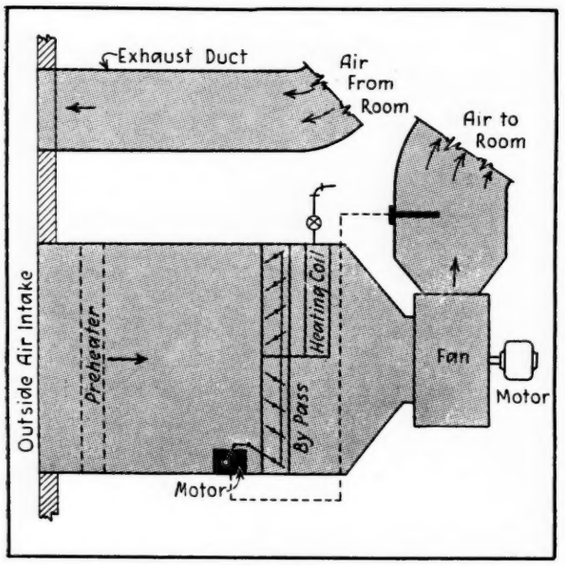


Fig. 2

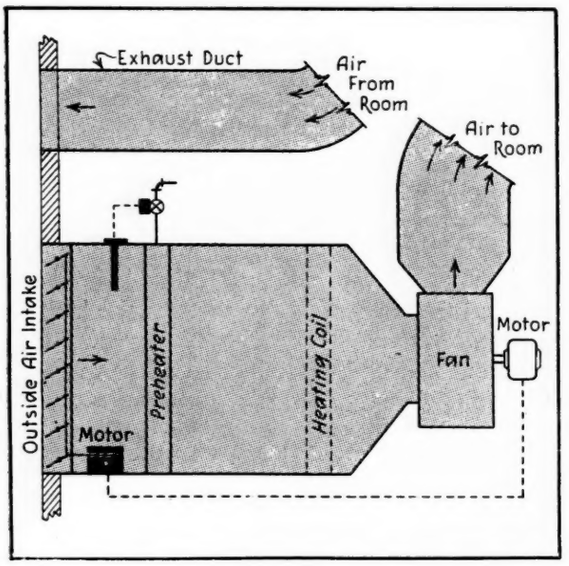


Fig. 3

trol arrangement being discussed affects only one of the coils. The coil not being discussed is shown in dotted lines. It is believed that this plan helps in keeping the relative position of the fixed parts of the system clearly in mind.

Fig. 1 shows a method of admitting steam to the heating coil under the automatic action of a controller in the fan discharge. Such an arrangement obviously does not give full operating control and in practice would be combined with other arrangements.

Here the heating coil extends across the entire cross-section of the intake air duct and all air entering the system must pass across this coil. The idea is to deliver air at a fixed predetermined temperature at or around 70° regardless of the fluctuations in outside temperature. As the fan handles a fixed quantity of air, obviously it is necessary to add more heat to the air at some times than at others.

With the control combination shown, as the temperature falls the valve in the steam line opens and must close as the temperature rises. The valve placed in the steam line is therefore of the type which is positioned by the controller, and the control is of the modulating or stepped or immediate type. Care must be exercised in selecting the valve for size so that when wide open it will permit enough steam to pass to supply the whole coil and so that at intermediate positions a suitable fraction of the steam flow when open will be obtained.

In Fig. 2 the heating coil extends only part way across the whole cross-section of the air intake duct—the familiar bypassing arrangement long used on ventilating systems. A compound damper is erected in the duct in such a way that when one part of it is opening the other part is closing. A damper motor is attached to this compound damper. The controller located in the fan discharge duct governs the position of the damper motor which in turn moves the damper louvers. As the temperature in the discharge rises the part of the damper controlling air flow through the heating coil (face damper) tends to close and that part controlling the bypassed air (bypass damper) tends to open. The action is reversed on a drop in temperature in the fan discharge. Here too the control is of the modulating or graduated type with the damper louvers capable of taking on various positions between wide open and tight shut. The heating coil operates with its steam supply wide open all the time or with manual control of the valve.

It is apparent at once that the arrangements shown in Figs. 1 and 2 can be combined. Such a combination gives more flexibility in the choice and arrangement than does either Fig. 1 or 2. Thus it is possible so to select controls that the amount of steam reaching the heating coil will increase at the same time that the amount of air passing through the face damper increases and decreases in like proportion until when the face damper is entirely closed the steam valve will also be entirely closed. Another selection of parts including a two-position valve in the steam line would permit keeping the steam valve wide open until the face damper closed, then shutting the steam valve tight. Other possible variations of equipment and arrangement

using Figs. 1 and 2 combined will be apparent with a little study.

Fig. 3 shows a damper controlled by a damper motor located in the air intake opening. It is connected to the fan motor or to a pressure controller in the fan discharge. When the fan starts the two-position damper motor opens the damper wide. When the fan stops the damper motor closes the damper. Thus outside air does not enter unless the fan is operating. It is evident that this feature could be used in connection with the arrangements shown in Fig. 1 or 2, if desired.

The other control combination in Fig. 3 shows the steam valve on the preheater operating under the command of a controller located in the air intake duct. Such a combination can be made up using either a two-position controller and valve or a graduated or modulating combination. With the two-position equipment the controller is usually set at a temperature above freezing and opens the steam valve wide at the temperature. It stays wide open as the outside temperature falls and closes at a temperature of perhaps 35°. This may cause overheating when the outside air temperature is around freezing. When modulating elements are used the controller should be so adjusted that the valve is wide open at or slightly above 32°.

Still another simple, or elementary, control of the preheating coil is shown in Fig. 4. Here a bypass around the preheater is used and the face and bypass dampers and the steam supply valve are all governed by a controller located in the intake duct but behind the preheating coil. The controller and damper motor are of the modulating type while the steam valve is of the two-position type. The position of the damper motor, and therefore of the dampers, is fixed by the controller. The steam valve is also opened or closed by the controller but the action is so arranged that the valve opens wide and stays open as long as any air is passing over the coil. The valve closes completely immediately after the face damper closes. This arrangement prevents the overheating sometimes resulting when the arrangement of Fig. 3 is used, and also reduces danger of freezing the condensate in the coil since the steam valve is wide open and the entire coil is heated whenever air passes over it.

None of the combinations so far shown have illustrated return or exhaust air from the room being mixed with outside air. Fig. 5 illustrates a case of this where the control operates to increase the amount of outdoor air as the heating load decreases and to use increasing quantities of return air as the outside temperature falls. Evidently in this case the position of the damper must be subject to control and the controller and damper motor are of the modulating type. A fixed air temperature at the controller is thus obtained by mixing of the warm return air with the cold outside air. Evidently also this temperature can never exceed the temperature of the return air. Commonly the controller is adjusted to a temperature below this. As some outside air is used, additional means of heating, not shown in the illustration, is usually included in the practical installation.

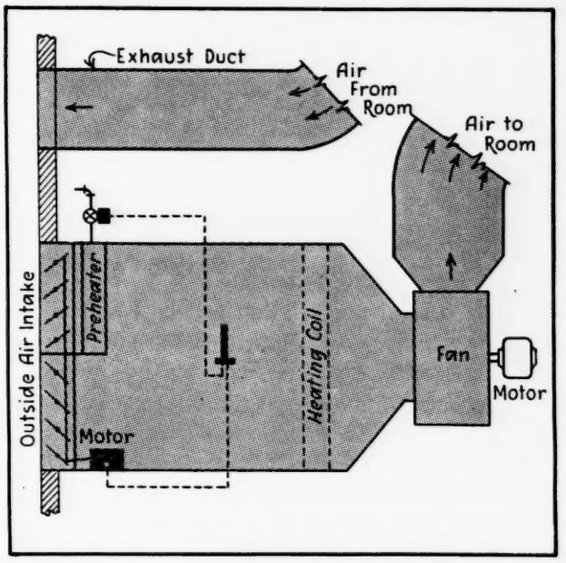


Fig. 4

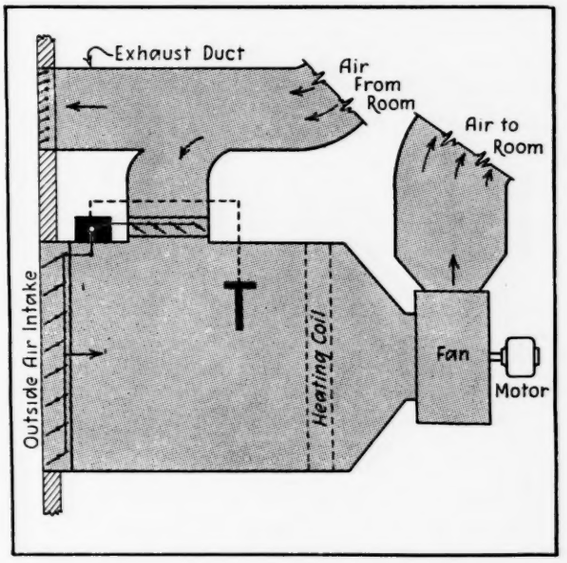


Fig. 5

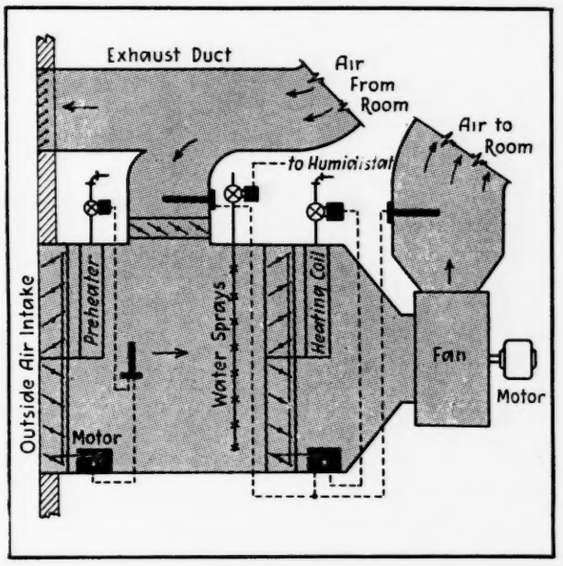


Fig. 6

Illustrations so far shown are all elementary combinations. Actual problems in practice very often require putting these elementary combinations together. It is putting them together in a suitable way to meet the operating requirements which calls for careful study and a thorough knowledge of the controls and of the expected operating conditions. It is not possible in available space to illustrate the many groupings which can be secured. One such grouping to serve as an example is shown in Fig. 6.

Here is a central fan installation for winter with outside air, return air, bypasses at the heaters, and humidification, and is for accomplishing both heating and ventilating. At the extreme left of Fig. 6 the elementary combination shown in Fig. 4 will be recognized. The controllers in the return air duct and in the fan discharge are Figs. 1 and 2 with the two combinations tied together. In addition a simple humidification combination is included with a humidistat, sprays, and a valve for controlling the spray water. The control combination at the left permits maintaining a fixed temperature in the outside air supply. The controller in the return air duct actuates the damper at the right to secure a fixed temperature in the air delivered to the fan. The controller in the fan discharge is a low limit control which repositions the dampers at the right if the air in the fan discharge duct falls to too low a temperature. The humidification combination acts to add moisture to the air as required by the setting of the humidistat. The return air damper is set manually.

Selective Air Conditioning Provided for Hotel

AT a cost of over $125,000, including installation of the largest air conditioning plant in any hotel in New England, a big program of modernizing has just been completed at the Hotel Kenmore, Boston. The improvements included redecoration and furnishing of the public rooms, and the creation of two entirely new public rooms. The air conditioning, designed especially for the hotel, provides for automatic air conditioning the year 'round, with quick change from cooling to heating.

One of the noteworthy points about this installation is its exact selection principle. The various functions, such as cooling or heating, dehumidification or humidifying, air cleaning and circulation are designed to operate independently of one another, to deliver properly conditioned air at all times, suited to the room where delivered. A crowded ballroom, for example, and an empty meeting room do not both receive air of the same temperature and humidity. Each has an independent automatic control, which brings the desired conditions to that room. Its extreme flexibility, through the independent automatic room controls, makes it possible for the system, if the outside temperature is satisfactory, to operate only as a humidity regulating system.

The basis of the system consists of a battery of four compressors—two of 15 tons, one of 20, and one of 10 tons—located in the hotel boiler room, and built upon a floating mat of concrete over which is a layer of 4-in. cork, which prevents the vibration from being carried to the rest of the building. A centrifugal pump, with a 6,000-gal.-per-hr. capacity, is similarly floated.

A further interesting feature is the fact that the water supply, instead of being from city mains, is drawn from a well driven on the premises. This well water is several degrees cooler than city water, a fact that maintains the efficiency of the cooling system in the hottest weather. The well supply, supplanting city water, also saves a heavy expense, being free, against heavy charges for an adequate city supply.

The Crystal Ballroom, accommodating 400 at dinner, 600 for meetings, or 500 dancing, and the only air conditioned ballroom in New England, is served by a specially designed chamber adjoining the outside wall, where a constant supply of fresh air is available. Air from the unit is passed into the room by a duct with 12 openings into the room on one side and one end. Return ducts utilize the old heating duct system under the windows on the opposite side. Overflow from the ballroom partially conditions the office lobby.

Next are the Silver Room and the beautiful new Embassy Room of gold and rose. This latter was created out of two large ground floor bedrooms at the back, at a cost of $10,000, and has folding doors that make it into two smaller rooms for bridge or committee meetings. These two have separate units, enclosed together in a penthouse built on the roof of a small court, with the Silver Room unit mounted on top of the Embassy unit, both with ducts discharging over the windows. They are insulated with cork, and the penthouse is insulated and weatherproofed. A 15-ton compressor takes care of this, while the 10-ton and one 15-ton compressor serve the Crystal Room. The 20-ton compressor takes care of units which serve the main dining room, Grill Room, formerly the coffee shop, and the handsome new Lounge Bar, created in satinwood finish, with ducts over the bar. The Grill Room unit is suspended from the ceiling of a service room directly adjoining. Smaller size ducts are used for the Lounge Bar, which also has a Frigidaire cooling unit for wines and beer, in a specially built brick vault under the sidewalk.

Temperature is controlled on a sliding scale, in a ratio of about five to two, to compensate for outside temperature. Humidity, in the cooling cycle, is controlled through bypasses maintained at a maximum of 50%. The heating cycle has two stages, the primary heat coil going on a 33° temperature. Dehumidification is accomplished by means of the secondary coil, without changing the temperature. Each unit provides 50% fresh air and 50% recirculated, with air changes about every four minutes and a total of about 22,000 c.f.m. of air to all rooms.

The system is designed to maintain a temperature of not over 80° and a relative average humidity of 50% when the outside temperature does not exceed 95° dry bulb, with 75° wet bulb. In winter, incoming air will be heated to maintain 75° when the outside temperature is not lower than 10° below zero.

GETTING DOWN TO FUNDAMENTALS

10—Accuracy and Use of Tabulated Values of Coefficient U

TABLES 5 and 6 give calculated values of U for use in equation (1) for roof constructions. As in the tables given in the preceding article the values are in B.t.u. per hour per degree temperature difference and are computed with the assumption that there is a 15-m.p.h. wind sweeping the outside surfaces. Tables 7 and 8 are for interior partitions while Tables 9 and 10 are for windows and skylights and for wood and metal doors respectively.

With complete tables thus made available a suitable computed value of U for use in equation (1) can be found for by far the great majority of building constructions met with in the course of ordinary practice.

Accuracy of the Table Values

These tables are computed from what may be regarded as the best information now available. During the past ten to twenty years a great deal of laboratory study and some small amount of field work have been carried on to determine values of the heat transfer properties of the various materials and constructions. Tables essentially similar to these in principle and computed from the same general formula have been in existence for a long period. Any differences between the values reported in these new tables and those shown in the older ones can thus be attributed to the effect of introducing newly developed information into the older tabular values.

It is interesting to compare the newer tables with some of the older ones. When this is done it develops that values of U as here tabulated are generally somewhat greater than those recommended for use some years ago for similar constructions.

To one interested in fundamentals this is a curious state of affairs, because whatever complaints there are by users of heat transmission coefficients are largely to the effect that experience shows that plants sized on the basis of even the older data were more likely to be oversized than undersized. What accounts for the fact that the newer coefficients take on increased values? Examination shows that there are several causes.

In early American textbooks and handbooks it is demonstrable in some and inferable in others that the values given for the coefficients, and the calculation factors on which the coefficients were based, were either taken bodily from the data of German investigators or were greatly affected by these findings. On the whole the German investigations were characteristically thorough and exhaustive. Gradually investigators in this country began to report test findings but many of them were from isolated tests undertaken without a comprehensive program. As these values found their way into use they were combined with the data already in existence with the result that there was much confusion.

While some of this arose from conflicting values of the heat conductivity of solid materials, the principal cause of the confused situation was, and still is for that matter, due to the air-to-surface values. Fixing these values has always been a troublesome problem. Certain of the German data indicate that the value of the coefficient involving the outside air would be of the order of 2.0, while the corresponding one for the inside surface would be about 1.6. American tests of twenty years ago placed the values for the inside surface at from 1.0 to 1.5 with an average of 1.34. American tests also indicated values of the outside air surface coefficient as being approximately three times the value of the inside coefficient, *at 15 m.p.h. of wind velocity.* This placed the value of the outside coefficient at 4.02 if this outside wind velocity were assumed. Elaborate tables using these two values were computed and wide-

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Previous articles have described the nature and direction of flow of the heat quantities on which the usual estimate is based. They are (a) transmitted heat, (b) heat from filtration air, and (c) heat from ventilation air, and may be expressed by the following equations:

$$\text{Transmitted Heat} = H = AU\,(t_i - t_o) \qquad (1)$$

$$\text{Heat from Filtration Air} = F = \frac{C(t_i - t_o)}{55} \qquad (2)$$

$$\text{Heat from Ventilation Air} = V = \frac{C_v(t_i - t_o)}{55} \qquad (3)$$

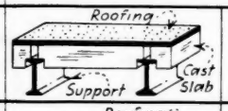
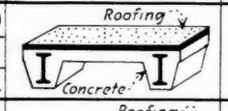
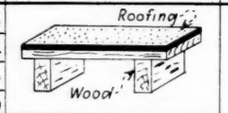
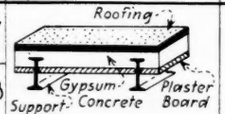
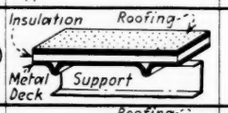
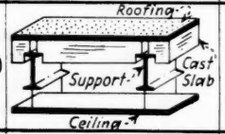
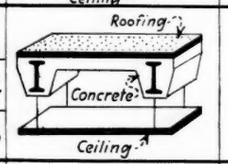
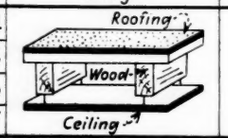
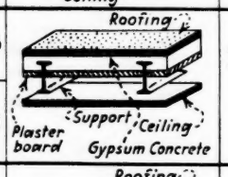
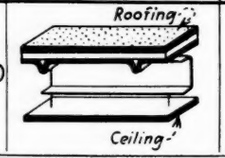
In these equations: H, F, and V are all in B.t.u. per hour:

A = Area, sq. ft. of surface through which heat passes
U = The transmission coefficient, air to air
C = Volume of filtration air flowing, cu. ft. per hr.
C_v = Volume of ventilation air flowing, cu. ft. per hr.
t_i = Temperature of indoor air, °F.
t_o = Temperature of outdoor air, °F.
$1/55 = 0.018$ = heat to raise 1 cu. ft. of air at 70° through 1°

Tables were presented indicating current ideas as to what values should be used for t_i and t_o under both summer and winter conditions. Methods of finding values of C in equation (2) and C_v in equation (3) were described, with tables. Thus all the necessary data for making calculations of the Heat from Filtration Air and the Heat from Ventilation Air have been presented.

We are now considering the fundamentals surrounding the calculation of the transmitted heat, especially as accomplished by equation (1). As values of t_i and t_o have already been fixed, our principal consideration is to present suitable values of U, the transmission coefficient, air to air. In the preceding article tables giving computed values of U for side walls and for floors and ceilings were presented.

TABLE 5.

FLAT & BUILT-UP ROOFS			Thickness of Roof Deck	A	B	C	D	E	F	G	H
					Rigid Insulation				Corkboard		
Construct No	Figures are in B.t.u. per hour per square foot per degree temperature difference, air to air, still air inside, 15 m.p.h. wind outside.			No Insulation	½"	1"	1½"	2"	1"	1½"	2"
99		Precast	15/8	0.83	0.37	0.23	0 17	0.14	0.22	0.16	0.13
100		Concrete	2	0.81	0.36	0.23	0.17	0.14	0.22	0.16	0.13
101			4	0.71	0.34	0.22	0.17	0.14	0.21	0.16	0.12
102			6	0.64	0.32	0.21	0.16	0.13	0.20	0.15	0.12
103		Wood	1	0.50	0.28	0.20	0.15	0.12	0.19	0.14	0.11
104			1½	0.37	0.24	0.17	0.14	0.11	0.17	0.13	0.11
105			2	0.32	0.22	0.16	0.13	0.11	0.16	0.12	0.10
106			4	0.18	0.14	0.12	0.10	0.085	0.11	0.094	0.081
107		2" Gypsum Fiber Concrete on ½" Plasterboard	2½	0.38	0.24	0 18	0.14	0.12	0.17	0.13	0.11
108			3½	0.31	0.21	0.16	0.13	0.11	0.15	0.12	0.10
109		Flat Metal	–	094	0.39	0.24	0.18	0 14	0.23	0.16	0 13
110		Precast	15/8	0 42	0 26	0.18	0.14	0.12	0.18	0.14	0.11
111		Concrete	2	042	0.26	0.18	0.14	0.12	0.18	0.14	0.11
112			4	0.39	0.25	0.18	0.14	0.12	0.17	0.14	0.11
113			6	0.37	0.24	0.17	0.14	0.11	0.17	0.13	0.11
114		Wood	1	0.32	0.21	0.16	0.13	0.11	0.15	0.12	0.10
115			1½	0.26	0.23	0.15	0.12	0.10	0.14	0.11	0.095
116			2	0.24	0.21	0.14	0.11	0.097	0.13	0.11	0.091
117			4	0.15	0.12	0.10	0.088	0.078	0.10	0.085	0.074
118		2" Gypsum Fiber Concrete on ½" Plasterboard	2½	0.27	0.19	0.15	0.12	0.10	0.14	0.11	0.096
119			3½	0.23	0.17	0.13	0.11	0.096	0.13	0.11	0.090
120		Flat Metal	–	0.45	0.27	0.19	0.15	0 12	0.18	0.14	0.11

ly published. The present tables are based on values of 1.6 and 6.0 respectively, again assuming a wind velocity of 15 m.p.h. Former tables also made no distinction between the inside surface coefficient and the coefficient used for spaces built into a construction. The present tables do make a distinction and use 1.6 in the one case and 2.2 in the other.

Trials in typical calculations and direct comparisons of the results show that for solid walls without air spaces the newer constants give values of U considerably greater than similar ones using the German data and moderately greater than those using 1.34 and 4.2 as the constants. With constructions involving internal air spaces the newer constants give values even more appreciably greater than those obtained by either of the older sets of figures. With heavily insulated walls the effect of surface coefficients is so slight that substantially the same results will be obtained by using any of the calculating factors mentioned.

The other principal contributing cause which has resulted in the increased values of U in the present tables is the placing of new conductivity values on certain of the solid substances. These are based on test reports and may be considered as reliable since testing methods with solids are not as troublesome as where air is involved.

It may thus be concluded that so far as accuracy of the several calculating factors is concerned the present tables represent the highest degree of accuracy yet attained even though the resulting values do seem to move in the opposite direction to what might be expected from experience. There is still no satisfactory explanation of this although it is probable that the reason has to do with the way the resulting tabular values of U are applied in practice.

The 15-M.P.H. Wind Velocity

One interesting point in connection with the coefficients has to do with the use of a wind velocity of 15 m.p.h. where constructions are exposed to outside wind conditions. So far as can be determined this figure is arbitrary. It seems to have been tacitly agreed that for American conditions in winter it was desirable to calculate coefficients for some considerable wind movement since records and experience both show that during the winter months winds of considerable velocity prevail in important parts of the country. Early tables were not at all uniform regarding the wind velocity for which they were computed. German data used low wind velocities and then made allowances for wind by means of additions to the heat quantity computed. Some of the early American data were obtained from tests where wind velocities were of the order of 15 m.p.h. Use of the American calculating constants from these tests had the effect of setting up 15 m.p.h. as the outside wind velocity in American tables. While there is thus nothing impressively fundamental about the way this figure came into use, still it is now with us and is continued in the present tables.

It is suggested however for the sake of those who like to keep their thinking straight that tables using 15-m.p.h. wind velocity are primarily for winter use. This figure of 15 m.p.h. is fixed by winter considerations and by far the greater part of the experimental work performed in arriving at the calculating factors was done under conditions such that the flow of heat was outward away from the building construction.

U for Summer Conditions

With the popularity of summer cooling installations in recent years these winter coefficients U have come into wide use in connection with the estimating of heat flows in summer. In the main they are so used by default and because there are no better ones handy and not at all because they necessarily fit summer conditions.

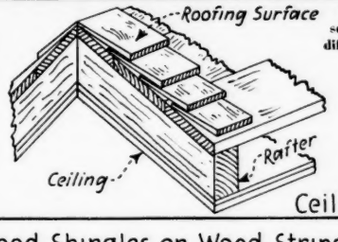
Two questions arise in connection with the use of these values of U for summer work. One has to do with the 15-m.p.h. velocity and the other is more basic in character and has to do with the broad question of whether the same reasoning and the same constants found for winter really do apply when the direction of heat flow is reversed. Recall that those who use them usually merely assume that they apply.

In regard to the first of these points it is doubtful if there is much justification for assuming a 15-m.p.h. wind to be prevailing in most parts of the country during the hottest days of summer. Quite probably the facts are that the wind velocity is considerably less than that figure. It should be noticed that in the case of many dwelling houses where the construction is rather light, use of a 5-m.p.h. wind velocity or of a "still air" coefficient would reduce the values of U to figures considerably smaller than those shown in the tables and would reduce the estimated heat gain due to transmitted heat by an important amount.

However, before concluding that new tables should be prepared for use in summer only it should be recalled that it is quite possible that a reduction of the wind velocity in summer might not have the same effect as would a corresponding reduction in winter. The reason for the doubt depends on the serious question of whether the summer wind is carrying heat to or away from the surface of the building construction. In winter with the outside surface of the construction at a temperature higher than the temperature of the air, the faster the wind blows the faster heat will be removed from the surface and therefore from the building. In summer, though, on account of sun heat the

TABLE 6.

WOOD FRAME PITCHED ROOFS			A	B	C	D	E	F
Construction No.	↓Roofing Surface	↓Type Insulation	No Ceiling	½" Plaster on Wood or Metal Lath or 3/8" Plasterboard	½" Rigid Insulation With or Without ½" Plaster	½" Plaster on 1" Rigid Insulation	½" Plaster on 1½" Corkboard	½" Plaster on 2" Corkboard
90	Wood Shingles on Wood Strips	No Insulation	0.45	0.28	0.22	0.17	0.12	0.10
91	Asphalt Composition, Tile or Slate on Wood Sheathing	No Insulation	0.54	0.31	0.23	0.17	0.13	0.10
92	Wood Shingles on Wood Strips, or Asphalt Shingles, Composition Roofing, or Slate or Tile Roofing on Wood Sheathing	½" Flexible	0.25	0.16	0.15	0.12	0.098	0.084
93		1" Flexible	0.17	0.12	0.12	0.10	0.083	0.073
94		Aluminum Foil on one side of Air Space	—	0.23	0.18	0.14	0.11	0.092
95		3⅝" Rockwool	—	0.063	0.059	0.054	0.050	0.045



Figures are in B.t.u. per hour per square foot per degree temperature difference, air to air, still air inside, 15 m.p.h. wind outside.

TABLE 7.

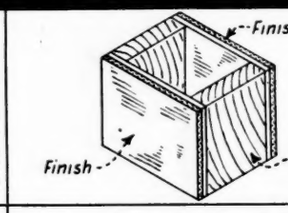
WOOD FRAME PARTITIONS		A	B	C	D	E	F
			Double Partitions				
Construction No.	 Figures are in B.t.u. per hour per square foot per degree temperature difference, air to air, still air both sides. Type of Partitions → ↓ Finish	Single Partitions (one side open)	Air Spaces Between Studding	Gypsum Fill Between Studding	One side of Stud Space Faced with bright Alum. foil	½" Flexible Insulation Between Studding (in Air Space)	3⅝" Rock Wool Fill Between Studding
53	Plaster on Wood lath or ⅜" Plasterboard	0.60	0.33	0.11	0.24	0.21	0.063
54	Plaster on Metal Lath	0 68	0 38	0.11	0.27	0.22	0.065

TABLE 8.

MASONRY PARTITIONS		No Plaster	Plastered One Side	Plastered Both Sides
96	4" Hollow Clay Tile — Figures are in B.t.u. per hour per square foot per degree temperature difference, air to air, still air both sides.	0.43	0.40	0.38
97	4" Common Brick	0.49	0.45	0.43
98	4" Hollow Gypsum Tile	0.29	0.28	0.27

surface temperature of the construction may become higher than the temperature of the surrounding air. This means that sun heat is being absorbed by the surface and is ready to flow inward toward the cooled space and thus *add* to the load. Any increase of wind velocity over the surface or any flow of cool water over it wipes the absorbed sun heat off before it gets a chance to penetrate the construction. Thus an increase in wind velocity in summer would tend to *decrease* the transmitted heat, and therefore to decrease values of U. This is exactly opposite to the winter effect.

There is doubt about the justification for the foregoing statements because the conditions obtaining in summer have never been as thoroughly analyzed as have those in winter. Neither has the theory been as well stated or as generally understood.

As a result of this consideration it seems that a thoroughgoing analysis of summer conditions surrounding the flow of transmitted heat and its estimation is badly needed before it will be possible to judge how well the winter coefficients are adapted to summer use. In the meantime there is no choice but to use them for both summer and winter purposes.

Summary

This series of articles has given consideration to the present state of data available for making the computations necessary before intelligent estimates of sizes and capacities of equipment can be attempted in the ordinary installation. The data have been presented in as much detail as possible with the result that the series has included virtually all such data as are now available. Attention has also been given to presenting the material in usable fashion. Comment on the material, both its virtues and its shortcomings, has been with the aim of encouraging an appraisal of this material at its true worth as what might be called the fundamental material which all of us use frequently. Obviously it is beneficial to all really to know the sources of the equations, their nature, and the degree of accuracy and dependability which an estimate deserves when based on our best current information used in the currently approved fashion.

With the available material thus presented and discussed one can scarcely escape the conclusion that our fundamental estimates are based on data which, although now in much improved condition, still hold many elements of doubt, still require a considerable resort to rule-of-thumb, and still can be regarded as little more than estimating rules to assist in guiding that large element of judgment still necessary in applying them. This is true regardless of which of the three quantities of heat is being estimated, whether the heat from filtration air, the heat from ventilation air, or the transmitted heat. We simply have not yet arrived at a point where the data are fundamentally satisfying—even though satisfactory results can be obtained when they are used with discretion.

TABLE 9.

Figures are in B.t.u. per hour per square foot per degree temperature difference, air to air, still air inside, 15 m.p.h. wind outside.

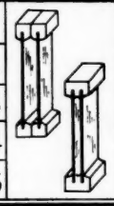
WINDOWS & SKYLIGHTS				
121		Single Sash	Double Strength Window Glass ⅛ in Thick	1.24
122		Double Sash		0.58
123		Triple Sash		0.78
124		Double Glazed Single Sash		0.63
125		Plate Glass ⅜ in Thick		1.19

TABLE 10.

Figures are in B.t.u. per hour per square foot per degree temperature difference, air to air, still air inside, 15 m.p.h. wind outside.

WOOD & METAL DOORS			
126		Thin Wood Doors with Glass	1.24
127		1" Wood Doors	0.70
128		2" Wood Doors	0.45
129		3" Wood Doors	0.30
130		Metal and Asbestos Doors	0 65

EDITORIALS

The Show at Chicago

Now that a full month has elapsed since the Exposition in Chicago there has been an opportunity to give some thought to what measure of success attended it. We have talked with many exhibitors and with a goodly number of visitors. Virtually all exhibitors expressed themselves as pleased with the results, while visitors were impressed with the quality and ingenuity used in making the exhibits attractive, interesting, and understandable.

We have heard but one adverse comment. It had to do with the excessively large number of the general public which attended. It is easy to see that there is a problem involved in finding a satisfactory way to limit the attendance at a show where there is much to attract popular interest. It does seem though that the problem is not beyond solution and that the Exposition should be kept as an industry affair rather than as a popular display. We doubt if it can be said that the problem is really acute now but it does seem as if it will have to be faced soon.

Our own impression of the whole show is that it was well organized, well conducted, and full of interest. The care given to the individual displays was a notable improvement over previous exhibits. So also was the spirit shown. Everywhere there was a feeling of optimism and a conviction that this year will see a decidedly better volume of business. We are inclined to believe that this improved spirit was really the outstanding feature not only of the Exposition but of the whole gathering in Chicago. Elsewhere in this issue are accounts of the show and of the several meetings.

●

Make Haste Slowly

Recently some gratifying progress has been made in formulating standards for certain phases of air conditioning work. In the main these standards cover phases which do not directly hinge on the question of what really constitutes comfortable conditions. It is well that this is so for in the background this problem still lurks and permanent standards cannot be fixed until it is solved.

Technically and scientifically the present evidence on what fixes the feeling of comfort in air has never been wholly satisfying. For one thing current data rest on the reactions and opinions of a small group of subjects. For another, it seems doubtful if the feeling of comfort in air is anything like the simple matter of combining certain temperatures with a relative humidity and some air motion, which simple matter has been assumed in a great deal of the experimental work done to date. The time of exposure is certainly a factor, and so also are such items as age, sex, clothing, surroundings, density of occupancy, and countless others. It will be a long time before the theory of comfort in air will be fully formulated, and a true knowledge of the subject can scarcely come until the several factors are enumerated and evaluated. In the meantime a little evidence is being added here and there. Much of it tends to confirm the beliefs of that little group which all along has held that little or nothing of a final nature is yet known about the real essentials of the problem of the feeling of comfort in air.

To our mind, however, this situation does not mean that temporary working standards for current use cannot be set up. They can be formulated but the fact that ideas are likely to change as time passes should be fully recognized and no code should attempt to fix comfort conditions in air which cannot be readily revised. We also believe that provision for a continuing review should be included in any attempted codification which may eventually find its way into laws or ordinances. There are already too many tragic examples where too early and unwisely rigid code provisions have throttled progress. Let's not repeat these mistakes in trying to codify what constitutes comfort in air.

●

Cooperation

For some time a carefully nurtured hope of ours has been that we might see the day when there would be improved cooperation among all the interests and sects which take part in producing equipment for heating, ventilating, or air conditioning and in getting this equipment installed and operating. Perhaps we are too hopeful but it does appear after all the bitterness and battling which have gone on, that here and there the idea is beginning to emerge that there are common interests among the groups each of which has so stoutly insisted that its own particular panacea is the only one. That community of interest is certainly there. We sincerely hope that we are interpreting the signs aright, and that the recent discussions, some open and some private, among the leaders of the interested groups are going to result in a more nearly coordinated program among manufacturers. Local organizations springing up are showing a commendable tendency to take into their ranks all interested groups instead of organizing along narrow lines.

While our interest in their movements has been passive it is none the less sincere. We are prepared to give active support in all ways possible but still feel that movements looking toward coordination of common interests are entirely fruitless unless they spring from the groups themselves. No amount of suggestion or promotion gets anywhere until internal conditions are right. When they do become right cooperative movements go ahead on their own power. That is the kind of cooperation needed among the many groups now having interests involved.

●

What About Title I?

Our information from Washington is to the effect that Title I of the housing act is to die a natural death on April 1. This is the part of the act which encourages modernization work through the insurance feature. Our belief, repeatedly expressed, is that this feature did a good deal to encourage activity in our industry at a time when some encouragement was badly needed. We are still of the opinion that its extension is to be desired. This in spite of the undoubted fact that the mere presence of this lending service has accomplished some of its objectives by directing attention of private lending agencies to what can be done with this type of service. Even if Title I goes we will no doubt continue to feel some of the beneficial effects for some time. We believe that the absence of a highly organized drive to secure extension of Title I is due largely to the feeling that new construction is in the offing and that most people in the building industry prefer to put their effort behind promoting more new construction if possible. At any rate, unless there is more of a crystallization of demand for retention of Title I it is fairly certain to expire.

WHAT READERS SAY . . .

Design Temperature in Concord

Would you be good enough . . . to let us know the usual trade custom as to the design temperature for heating in Concord, N. H. . . . The only data available to us at the present is the Weather Bureau record of — 35° minimum; tentatively we are figuring radiation on the basis of — 20°.

From the experience of plants we have designed in southern Vermont and around Albany, we are reasonably sure that — 20° is a low enough temperature to figure, but are wondering whether — 15° might not be safe for good results.

New York, N. Y. L.C.L.

According to an engineering office in Concord, the design temperature used in that city is — 10° as reported in a survey made by HEATING & VENTILATING in the spring of 1933.

Following the cold wave in late January and early February, 1934, we again made a survey on this subject to see if new low records had been established in any of the cities on our list. This was not the case, however, in Concord where the record low of — 35° was made in January, 1878. The winter of 1933-34 had a cold wave which reached — 21°.

We agree with the third paragraph in your letter that — 20° is a safe figure, but since this was reached in 1933 and 1934 we are inclined to think that — 15° might not be a safe enough figure.

●

Forced Warm Air

Can you recommend a book or formula for calculating the heat requirements on a hot air heating system with fan attachment? The methods that I have seen and used are much too slow and complicated when compared to quick methods for calculating steam or hot water heat plants.

I wonder if ducts can be as readily ascertained for relative heating loads as steel pipe is for cast iron radiation.

Waukegan Engineering Co., CHARLES RATTNER.
New York, N. Y.

. . . We know of no formula for quick calculation of such a system. . . . The most reliable method we have seen so far is contained in an article which appeared in the August and September, 1935 issues of HEATING & VENTILATING entitled "Calculation and Design of Mechanical Warm Air Heating Systems," by J. Donald Kroeker.

●

Gas Conversions

Recently, you have been running a series of articles in HEATING & VENTILATING entitled "Engineering Gas Conversion Burner Installations," by A. G. Canar, in which we are interested.

Will you please inform us if you intend issuing this series of articles in pamphlet form; if not, whether it would be possible for us to get a reprint of the entire series, together with costs.

Purchasing & Stores Division, W. A. MALLOY.
Central Hudson Gas & Electric Corp.,
Poughkeepsie, N. Y.

. . . we have given some thought to reprinting the series by A. G. Canar in pamphlet form, but it now seems unlikely that we will do so.

The only way we know for you to get the entire series together is to take the pages from the issues of the magazine in which they appear. Installments of this series have been carried in the following issues: September, October, November, and December, 1935, and January and February, 1936.

We regret that all issues containing this series are out of stock with the exception of the January and February, 1936, issues. These are available at 30 cents per copy.

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Steel Boiler Pressures

This refers to your letter . . . You mentioned "steel heating boilers, designed for operation at from 10 to 40 or 50 lb." Boiler representatives from whom I have received information quote on 15 lb. and 100 lb. without an intermediate rating. The prices for the 100 lb. ratings are considerably higher than those for the 15 lb. ratings. I had hoped to be able to obtain a 25 lb. or 40 lb. boiler at a cost not greatly in excess of the cost of the 15 lb. boiler. I shall appreciate it if you can send me names of manufacturers of boilers with intermediate ratings . . .

Cleveland, Ohio. L. B. C.

. . . we are advised by the Steel Heating Boiler Institute that, except on special orders, steel boilers are made only for 15-lb. and 100-lb. working pressures . . . if you require a greater working pressure than 15 lb. you will have to purchase a 100-lb boiler.

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Oil and Electric Heat

Kindly let me know if you can mail me or where can I secure Reprint 39 and Bulletin 46. Both of these were mentioned under "Heating and Heat Transfer," page 69, HEATING & VENTILATING, January, 1936, issue.

Roxbury, Mass. J. F. F.

You can obtain the paper on a "Survey of Oil Burning Heating Plants in Residences" directly from the University of Wisconsin, Madison, Wis. Ask for Reprint 39. There may be a small charge for this paper.

The paper "The Feasibility of Using a Heat Storage Device for Domestic Heating with Electricity," published by the State College of Washington, was abstracted in our February issue. If you desire to obtain a copy of the paper, write to the State College of Washington, Pullman, Wash., and ask for Engineering Bulletin 46.

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Radiators and Convectors

. . . On pages 62 to 67, inclusive, of your January, 1936 issue you show a statistical review of heating products.

We are very much interested in the amount of cast iron radiation, copper convectors, and cast iron convectors sold in recent years and would like to know your source of information on these items.

Inland Heating Co., WM. J. MASONER,
Chicago, Ill. President.

. . . Statistics on non-ferrous and cast iron convectors are reported by the Bureau of Census. Department of Commerce, Washington, D. C. The source of our information on cast iron radiators is the Institute of Boiler & Radiator Manufacturers, Geneva, N. Y.

Fuel Estimating

Can you advise us of a fairly reliable formula to estimate the amount of coal for a heating season in an average boiler, both steam and hot water, the coal to be anthracite of nut, stove, and egg sizes, possible for one kind; and rice and buckwheat for another.

For instance: We have a proposition now of a house in Canandaigua having 1,500 ft. of standing radiation, and would like to determine approximately how much coal it would take to heat this place, which is an old fashioned house, rebuilt into three apartments. The ceilings are exceptionally high, as they used to put in the finer houses years ago. This particular place has a United States boiler No. 277 G.

If you can favor us with some figure which we might use on the tonnage of coal required per 100 ft. of standing radiation, it would be greatly appreciated.

Rochester, N. Y. G. E. H.

We suggest that you use the degree-day method. This method was explained in HEATING & VENTILATING's Reference Data Sheets Nos. 67-68 which appeared in the December, 1935, issue. You will notice that this data sheet shows that 0.008 lb. of coal is used per square foot of radiator surface per degree-day. This figure applies to a steam system designed to maintain 70° in zero weather, when burning coal having a heat content of 12,000 B.t.u. per lb., and when operating at 100% efficiency. Naturally, the plant will not operate at 100% efficiency, and the figure will have to be corrected for this variation. It will also have to be corrected if a different design temperature is used and if the coal has a different heat content. These corrections are explained on the data sheet. If we assume that the system in the house in Canandaigua is designed to maintain 70° inside temperature when the outside temperature is 0°, and that it is burning 12,000 B.t.u. per lb. coal, and the efficiency of the system is 50%, the amount of coal used per square foot of radiator surface per degree-day would be 0.016. Since the normal yearly degree-days for Rochester are 6,732, the amount of coal consumed for each square foot of heating surface would be 6,732 x 0.016, or 107.7 lb. per sq. ft. per heating season. For 1,500 ft. of radiator surface the coal consumption would be 1,500 x 107.7 = 161,550 lb., or approximately 80 tons.

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Air Density

I am interested in the tables you publish on pages 46-48 of the February issue of HEATING & VENTILATING. I am very glad to see these tables.

I am particularly interested in the repetition of Table 1 between pages 54 and 55. This is just the right size for a notebook. Please advise how I can get Tables 2, 3, and 4 in similar form for a notebook to save mutilating the magazine on pages 47 and 48.

While writing to you I would like to suggest that the author of the article use a different form of equation for filtration and ventilation air, which is specific heat times weight of air times temperature difference, whereas he uses instead the air volume divided by 55+ times the difference. This is O.K. if the temperature is 70° but would be all wrong if some other temperature had to be maintained. It is a simple matter on the slide rule to calculate the weight of air per hour for any temperature.

Warren Webster & Co., Orlando, Fla. G. R. MACNAMARA, District Manager.

We are pleased to . . . know of your interest in the tables giving the values of the heat transmission coefficients which we have started to publish. The one given on the blue sheet in our February issue contains Table 1 of this series. A similar blue sheet which will appear in the March issue will contain Tables 2, 3, and 4, while following blue data sheets—one appearing each month—will carry the remaining tables. In the course of the next two or three months, therefore, you should have a complete set of these tables, all on uniform paper, and will not have to cut any of these pages from the magazine itself.

We note your comment about the form in which we give the equation for filtration and ventilation air, and agree that it would probably be better to give the formula in terms which would put density into the equation rather than using 55. In some of our previous blue reference data sheets we do make use of this idea and do use the air density as a factor. However, the formula has been so long used in heating calculations with a 55 denominator that we thought it would be better to repeat it in that style so that it would be recognized, rather than to use the air density and change the appearance of the equation.

●

Concrete Walls

I have been able to derive quite a number of the values of the coefficient U in the article "Getting Down to Fundamentals—Part 9" in the February issue. I have had trouble making concrete floors and walls check.

Using k and C from Reference Data Sheet No. 69, January, 1935 issue, for concrete on ground with 1-in. tile, I used:

8-in. concrete	1/1.0	= 1.000
1-in. tile	1/12	= 0.083
Inside air	1/1.65	= 0.606
		1.689

Now, 1/1.689 is 0.59 = U, and in the tables page 48, February issue, U is given as 0.75. . . . Likewise I cannot derive the concrete wall factors.

Little Rock Gas & Fuel Co., Little Rock, Ark. W. S. HYDE.

. . . Our set-up is as follows:

8-in. concrete	8/12	= 0.667
1-in. tile	1/12	= 0.083
Inside air	1/1.6	= 0.625
		1.375

Now 1/1.375 = 0.73. This is the value which appears in our Reference Data Sheet in the February issue. It would appear from the data which you sent with your letter that your use of 8-in. concrete as 1/1 = 1 is the principal reason your calculation did not agree with ours. You will note that we use 8/12 for 8-in. concrete. For 1-in. concrete it would be 1/12. In other words, we put the thickness of the concrete in the numerator, and keep the denominator as 12 which is the value of the specific conductivity of concrete 1 in. thick. If you fail to check our values for the concrete wall factors it may also be due to this same variation of method in calculating the factors.

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Conductivity Tables

In your issue of January, 1936, Reference Data No. 69, opposite page 106, you give the following heat conductivity for Thermofill:

34.0 lb.	0.23
19.8 "	0.35

This varies so widely from other published data on this material and is reversed for density, that is the greater density has a lower conductivity, that I wonder if there may not be an error in these figures.

Memphis, Tenn. F. T. HINDMAN.

The figure for density of 34 lb. per cu. ft. is incorrect. Instead of 0.23 it should have been 0.60.

ABSTRACTS of Current Papers, Books and Pamphlets

Controlled Humidity in Industry

Perhaps the most important factor in industrial air conditioning is the control of the relative humidity. This is especially true in the textile industry where the maintenance of a high humidity is an absolute necessity. Because of the large number of textile mills located in England, this division of air conditioning has received a large part of the attention of British engineers and they have developed a variety of equipment for the control of air moisture.

The purpose of this book is to review the question of the control of humidity under industrial conditions and to explain the principles of the instruments and equipment used. It does not attempt to show how the equipment can be adapted to any particular plant or to explain the methods of manufacturing the equipment. Details of construction are shown only as a help to the understanding of the operating principles of the equipment.

In the first section of the book the author presents an explanation of the more important fundamentals of humidity. Only enough is included so that the reader not previously familiar with this subject will be able to profitably study the operation of the equipment.

The chapter on the measurement of relative humidity is one of the best in the book, for the author presents a rather complete listing and explanation of the various instruments used for indicating the moisture conditions of the air.

The remainder of the book is taken up with methods of increasing and decreasing relative humidity, central air conditioning plants, automatic humidity controls, thermostats and humidity control in testing rooms and laboratories.

[*"Controlled Humidity in Industry," by M. C. Marsh. Published in U. S. by J. B. Lippincott Co., Philadelphia, Pa. Cloth-bound; 6 x 9 in.; 123 pages; price $2.50.*]

●

Gaseous Fuels in Warm Air Furnaces

Some years ago the Engineering Station at Purdue University conducted a series of tests in order to determine the relative merits of gas heating with a gas designed steam boiler as against heating with a gas conversion burner in a coal designed boiler. The tests clearly indicated that gas conversion burners when properly installed—and correctly adjusted—in boilers designed for solid fuel gave as high efficiencies as were secured with boilers built expressly for gaseous fuel. On completion of these tests arrangements were made for a similar study in regard to the use of gas in warm air heating plants.

The primary purpose was to secure an indication of the efficiencies of gas conversion burners and to obtain similar data on a gas designed warm air furnace for the purpose of comparison. After these tests had been completed it was decided to make a study of the effect of increasing the rate of air circulation—as by the use of fans in cold air ducts—on the efficiency of the heating plant. The effect which an increase or decrease in the rate of heat input had on the efficiency of the plant was also given consideration.

The tests showed that gas designed furnaces are more efficient than are solid fuel furnaces, when converted to the use of gaseous fuel, in the conveyance of heat to the desired point under the gravity flow system of air circulation. In effectiveness of combustion, however, gas conversion burners are just as efficient as the burners on a gas designed furnace.

It was also found that if a fan is used to promote circulation of the air through the heating plant of a converted system, the efficiency of the system will be increased so that it will compare favorably with that of a gas designed furnace. The forced air circulation may also be expected to reduce the radiation of heat into the basement with a consequent gain of heat where it is most required.

[*"Investigation of the Use of Gaseous Fuel in Warm-Air Furnaces," by R. B. Leckie. Research Series No. 48, Engineering Experiment Station, Purdue University, Lafayette, Ind. Paper-bound; 6 x 9 in.; 47 pages.*]

●

How to Protect Business Ideas

Corporations and individuals anxious to protect their rights to distinguishing ideas and designs will find here a reliable guide to forestall legal difficulties, litigations and infringements.

Threats of lawsuits for infringement of salable business ideas are constantly on the increase. This trend is gradually driving home the realization to inventors, business concerns, and trade associations that not only the creative but the legal angle as well must be taken into consideration.

This book presents in one volume a simple yet authoritative study of what to most people is unknown territory —the story of how to obtain and use to the best advantage trade marks, patents, copyrights, labels and kindred properties.

Anyone wishing to promote ideas or suggestions dealing with any one of a number of fields—merchandise, machines, formulas, processes, designs or advertising—will find this new volume an invaluable handbook of advice and suggestions for the protection of his legal rights and privileges.

[*"How to Protect Business Ideas," by William H. Leahy. Published by Harper & Brothers, New York. Cloth-bound; 6 x 9 in.; 157 pages; price $2.50.*]

●

Power Plant Chemistry

This is the fourth edition of a book formerly known under the title of Engine Room Chemistry. The purpose of the book is to present the fundamentals of engine room chemistry in a simple, practical manner for persons with only a small amount of technical training who are interested in securing a knowledge of the origin, production, and various uses of fuel, water, and lubricants and the methods of testing them.

The changes in the present edition consist of the enlargement of the chapter on fuels, by the edition of methods of storage and sampling of coal and specifications for Diesel and other liquid fuels. The chapter on combustion has been revised so that the latest method of carbon dioxide determination can be described. Other changes consist of additions to the chapters on boiler scale and corrosion, and also additions of specifications for lubricating oils.

The subjects covered include apparatus and chemicals, fuels and their analysis, regulation of combustion, boiler scale, mineral oils, animal and vegetable oils and greases.

[*"Power Plant Chemistry," by A. H. Gill. Published by McGraw-Hill, New York. Cloth-bound; 6 x 9 in.; 228 pages; price $2.50.*]

(Continued on page 78)

NEWS OF THE MONTH

Fuel and Stoker Conference at Wisconsin

MADISON, WIS. — The tentative program of the annual Conference on Solid Fuels and Domestic Stokers to be held at the University of Wisconsin here April 21-23 has been released by L. A. Wilson, chairman of the conference. The tentative program follows:

The Competitive Fuel Situation, Ben G. Elliott, professor of mechanical engineering, University of Wisconsin; Stokers—The Vest of the Coal Man's Suit, A. H. Thornton, Minnesota district manager, A. E. Bergman Inc., St. Paul; Packaged Fuel, R. F. Mitten, C. M. Eberling Co., Cleveland; The Elementary Phases of Combustion from the Hand Fired and Stoker Standpoint, R. G. Johansen, president, The Hays Institute, Chicago; Fundamentals of Domestic Stoker Merchandising, A. E. Bergman, president, A. E. Bergman Inc., Eau Claire, Wis.; Stoker Coal, F. R. Kimmel, general manager, stoker division, Anchor Stove & Range Co., New Albany, Ind.; Air Pollution—Its Prevention and Control, with movies, H. D. Blackwell, smoke consultant, Chicago; Psychology of the Fuel User, and Customer Turnover, K. C. Richmond, managing editor, *Coal Heat*, Chicago; Air Control with Stokers, R. E. Bressler, chief engineer, Paragon Kol-Master Corp., Oregon, Ill.; Methods of Dustless Treatment, Berry N. Beaman, sales manager, Viking Manufacturing Co., Jackson, Mich.; Modern Methods in Fuel Marketing, A. J. Chouinard, assistant sales manager, Sahara Coal Co., Chicago; Fuel Engineering, George G. Ritchie, fuel service engineer, Chesapeake & Ohio Lines, Richmond, Va.; The Use of Pocahontas Coal in Stokers, Robert M. Pilcher, assistant engineer of tests, Norfolk & Western Railway Co., Roanoke, Va.; Sales Promotion — How to Make Them Buy, C. Franklin Brown, C. Franklin Brown & Co., Chicago; Merchandising Can be Made Simple, Carl C. Degenhardt, The United Coal & Dock Co., Milwaukee.

Toronto Architects Hear A.C. Talk

TORONTO, ONT.—Much interest is being manifested by members of the Ontario Association of Architects in the air conditioning industry which is rapidly showing the owners of small buildings as well as the large ones, that air conditioning is a wise investment. A. S. Mathers, who recently addressed the Ontario Association of Architects on the subject of "Air Conditioning," declared that "air conditioning is now fast replacing former systems of heating and is to my mind the greatest factor contributing to human comfort in the realm of modern building."

A.C. Up in Chicago for January

CHICAGO — First indications that air conditioning installations here in 1936 would greatly exceed those in 1935 were shown in a survey made by a local utility company which recorded 17 contracts let in January, 1936, as compared to only 13 during that same period last year. Three of these which are outstanding were for air conditioning five floors of the Federal Reserve Bank, four floors of an office building and a large restaurant. In addition to these contracts were awarded for smaller systems in business places of the following classifications: offices, 4; restaurants, 4; retail stores, 3; industrial, 2, and undertaking, 1.

During the year 1935 a total of 317 installations were made in Chicago according to the utility company's survey. This is about a third better than the 238 made in 1934 and more than double the 124 systems installed during 1933. Among the different classes of buildings or business air conditioned last year private office installations led with 61 while restaurants were second with 51 and theaters and general offices followed, each including 31 installations. The survey showed only 24 residential installations. It was pointed out that this figure was low because the survey took in only the city of Chicago proper where few residences were built during the year. Had suburban areas been included this figure would undoubtedly have been much higher.

Buffalo A.C. Standards Prepared

BUFFALO, N. Y.—The report of the Committee on Air Conditioning Standards for Buffalo was presented before the February dinner-meeting of the Western New York Chapter of the ASHVE, February 10. A copy of the Standards will be sent to each member of the Chapter for study to prepare members for a discussion.

A portion of the cooling coils made for the American Sheet & Tin Plate's new rolling mill by Young Radiator Company. The complete bank will be 46½ ft. wide and 10½ ft. high with a weight of nearly 12 tons and will have a heat transfer of nearly 10 million B.t.u. per hr.

Short Course Scheduled at Ames

AMES, IA.—A state air conditioning conference will be conducted by Iowa State College under the auspices of the mechanical engineering department and the Engineering Extension Service here March 25-27. The conference is open to everyone interested in heating and air conditioning including engineers, building employes and heating contractors and dealers. Among the subjects to be treated will be: Fundamentals and Scientific Laws Affecting Air Conditioning; Trends in Air Conditioning—Unit and Central Fan Systems; Design of Forced Air Heating Systems for Air Conditioning; Building Heat Losses and Heat Gains—Body Heat Losses; Comfort Standards for Summer Air Conditioning—Effective Temperatures; Fundamentals of Humidification—Temperature and Humidity Control; Air Cleaning Devices—Humidifiers and Air Washers; Minimum Requirements for Ventilation; Operating Costs of Air Conditioning; Air Conditioning the Small Building—Industrial Air Conditioning; Research on Residential Air Conditioning.

Dutch to be Hosts of Refrigeration Congress

AMSTERDAM, HOLLAND—The 7th International Congress of Refrigeration organized by L'Institut International du Froid and The Netherlands Association of Refrigeration will be held in this city and The Hague in June, 1936. The official opening and the sessions of the congress will be held at The Hague, while the official closing will be held at Amsterdam.

The work of the Congress will be divided into four sessions; one on refrigerating machines and materials including air conditioning; general applications of refrigeration; refrigerated transport, and scientific. The Congress will open Tuesday, June 16, and close Saturday, June 20. Section meetings will be held June 17-19.

Further information can be obtained from the Organization Office of the 7th International Congress of Refrigeration, 107 Stolberglaan, The Hague, Holland.

Utility Installs A.C.

NEWARK, N. J.—Year 'round conditioning is planned by Public Service Electric & Gas Company for its central addressing and billing departments in the Newark Terminal Building. The offices will be cooled and dehumidified in summer, ventilated and humidified in winter.

Martin Re-elected by Stoker Group

CHICAGO—J. E. Martin, Chicago, manager of the stoker division, Link-Belt Company, was re-elected president of the Midwest Stoker Association at the annual meeting held January 27. W. J. O'Neil, sales manager, Chicago branch, Iron Fireman Manufacturing Company, was elected vice-president, and H. L. Bilsborough, Chicago, sales manager, stoker division, Fairbanks, Morse & Company, was elected secretary-treasurer. These three officers with Stevens H. Hammond, manager, underfeed stoker division, Whiting Corp., Harvey, Ill., and A. R. Odell, Chicago branch manager, Combustioneer division, Steel Engineering Products Co., constitute the new board of directors of the Association.

A number of subjects concerning the local Chicago situation were discussed and a definite program of activity outlined for the ensuing year.

Fan Makers Meet

CHICAGO—A year of rapidly increasing business and sales volume for the ventilation and air conditioning industry during 1936 was forecast by the members of the National Association of Fan Manufacturers during its annual meeting, held at the Palmer House, January 29.

The following officers were elected for the coming year: president, John M. Frank, Ilg Electric Ventilating Company; vice-president, Fred Herlan, B. F. Sturtevant Company; secretary, L. O. Monroe.

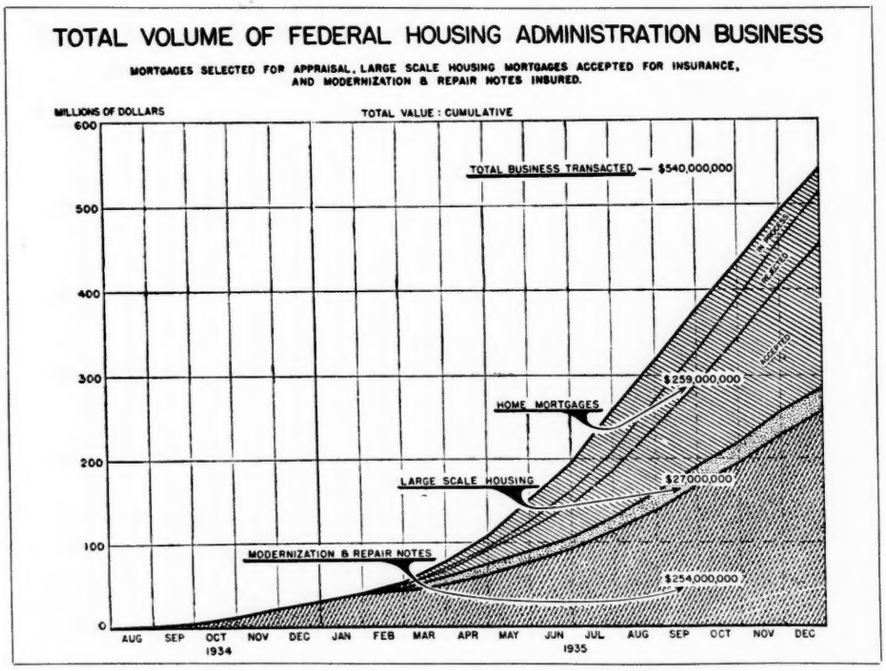
Ahlff Heads Convector Association

CHICAGO—At the annual meeting of the Convector Manufacturers Association, held here January 27-31, A. A. Ahlff, of Chase Brass & Copper Company, was elected president. Following his election, Mr. Ahlff made the following statement: "Much has been accomplished by the Convector Manufacturers Association in the way of standardized widths, heights, and lengths, as well as ratings of copper convectors. Their application has been simplified for the architect, engineer, and heating contractor. New applications are continually being brought out, and the field is limitless.

"The copper convector has firmly established its place in the sun, and is now a definite part of the heating industry. There exists a spirit of friendly cooperation among the members of this Association, and it is our aim to do our utmost to make 1936 the best year the copper convector industry has experienced."

200 More Gas Jobs

BROOKLYN—The Brooklyn Union Gas Company has announced that since December 15, when new low rates for house and industrial water heating went into effect, it has added to its lines more than 200 house-heating units. Besides these, 233 water heaters, a number of space heaters for lofts, and miscellaneous industrial and commercial appliances have been sold. As a result of the new rates the company expects to add 3 billion cubic feet to its load during the next three years.



Compiled by FHA's Division of Economics and Statistics, this chart shows the total business at the end of 1935 in the different divisions of insured loans for building backed by FHA.

Arco to Display Basement Models

NEW YORK—To present to the public a clear understanding of American Radiator conditioning systems and at the same time show how the cellar can be modernized and used as an extra room in the house by installing these systems, American Radiator Company is showing a collection of 36 miniature basement rooms complete with furnishings and featuring all types of systems.

The initial showing of the miniatures will be held on the roof of the French Building in Rockefeller Center in an exposition to be known as "The Cellar Reborn." It will be open to dealers, contractors, builders, decorators, architects and the public in general for two weeks beginning March 9. Following this first showing the company plans to place the models on exhibition in different cities throughout the country for the rest of the year.

The initial showing of the miniatures will be opened by Stewart McDonald, Federal Housing Administrator, and the judges in the contest in which the models were built, Mrs. Eleanor S. McMillen, Aymar Embury II, and Rolland J. Hamilton, president of American Radiator Company.

The miniature rooms, built on a 1 in. to 1 ft. scale, were made by the students of the New York School of Fine & Applied Art, in a basement modernization contest conducted by American Radiator. All the boilers, air conditioners, valves, tees and elbows, and other accessories were cast in sheet metal, brass and copper by professional model makers for the company. Copper pipe was used exclusively in all basements and was installed by model makers under engineering supervision. Each student was given a plan and pictures of a basement that is actually in existence today and from that plan he converted the basement into an extra room in the house, to be used as a rumpus, hobby, study, utility, sports, or children's playroom.

Winter A.C. Course

EAST LANSING, MICH.—The fourth annual short course on warm air heating and cooling will be held at Michigan State College March 31-April 3 under the auspices of the National Warm Air Heating and Air Conditioning Association. Included in the course will be the theory necessary in making calculations for a complete air conditioning installation in an insulated home. Instructors will be men identified with the industry. The cost of the course is a $2 registration fee.

Those interested should address Prof. L. G. Miller, department of mechanical engineering, Michigan State College, East Lansing, Mich., and enclose $2 to cover their registration fee since only 300 can be accommodated.

Midwest Power Show to Feature Education

CHICAGO — The educational phase of the power industry will be emphasized at the Midwest Engineering & Power Exposition and the Power Engineering Conference April 20-24 in Chicago, according to G. E. Pfisterer, manager of the exposition.

To show by contrast what has been accomplished in the last 200 years, several universities have promised displays of old models of engines and power equipment. Coal companies will have exhibits of model coal mines, particularly showing the hoisting and sorting of coal. Similarly, diesel and internal combustion engine manufacturers are concentrating on understandable exhibits of their products. Electricity will also be emphasized, as will gas and steam power.

All major activities of the conference program are virtually complete. There will be 12 sessions with approximately 35 papers by leading engineers, each a recognized authority in his field. The program has been organized with the cooperation of the various participating engineering societies.

Among the papers to be presented will be those on refrigeration, power piping and welding, and fuels, all of which will be treated on the third day of the conference.

More A.C. Cars for the New Haven

BOSTON—Orders issued by the United States District Court here authorize the New Haven Railroad to air condition 88 passenger cars, rebuild two coaches into a streamlined train unit, and buy 10 Diesel engine switching locomotives. Upon completion of this program the New Haven will have 470 air conditioned cars and all its modern steel coaches, used in through main line and the longer branch services, will be air conditioned.

Some of the newly authorized air conditioned cars will be equipped by the Safety Car Heating & Lighting Company and the others by B. F. Sturtevant Company. All the equipment will be installed at the railroad's Readville, Mass., car shops.

Winnipeg Chapter Elects

WINNIPEG, MAN. — The Manitoba Chapter of the ASHVE met recently in the Marlborough Hotel here, and completed all plans for the functioning of the new organization. J. B. Steele, of this city was elected president. Other officers are: vice-president, D. F. Michie; secretary, C. H. Turland; treasurer, H. R. Eade; board of directors, William Glass, B. G. Jones, James Y. Yates, the latter two of Brandon.

It was decided to meet on the fourth Thursday of each month at the Fort Garry Hotel, this city.

Boyden Reviews Show

BOSTON—Members of the Air Conditioning Bureau held their regular monthly meeting February 26 at the Edison Auditorium. Guest speakers were Prof. James Holt, Massachusetts Institute of Technology, and D. S. Boyden, first vice-president, ASHVE. Mr. Boyden gave a brief review of the 4th International Heating and Ventilating Exposition in Chicago, together with a report of the 42nd annual meeting of the ASHVE. Other Bureau members who attended the convention also told of their experiences.

Cleveland Show Progresses

CLEVELAND—More than half the available space in Cleveland's Great Lakes Exposition, June 27-October 4, has already been sold, according to L. G. Dickey, general manager.

Among the companies that have already made space reservations are: The Perfection Stove Company; The Cleveland Cooperative Stove Company; The Forest City Foundries; The Henry Furnace and Foundry Company; The Republic Steel Corporation; International Nickel Company, and The Youngstown Sheet & Tube Company.

Gas Heating Up

SEATTLE—A reduction of 25% in gas house-heating rates by the Seattle Gas Company during the latter part of 1935 has speeded sales of gas heating equipment here. This brings the total reduction in gas rates since 1928 to 43%.

Boiler Nameplates Asked in Law

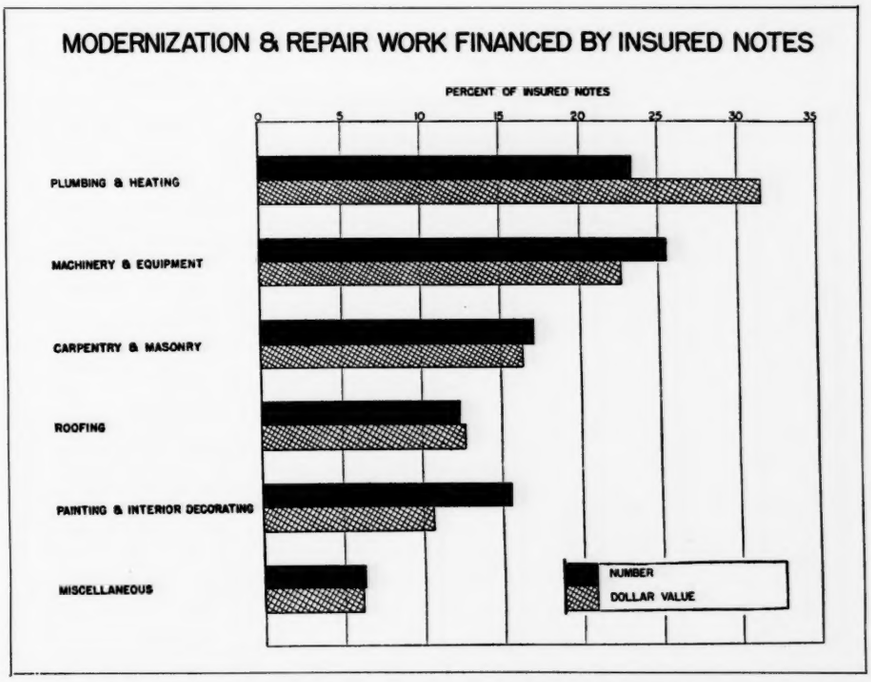
BOSTON—A bill is now before the legislative committee of public safety to require boiler manufacturers to stamp in the metal of their boilers the name of the maker, size, and pressure of the product. Backed by the Massachusetts Master Plumbers' Association, it is alleged that unscrupulous wholesalers are selling boilers on which they stencil the volume and pressure of the boiler to suit the order, regardless of its actual capacity. President Philip S. Bailey, president of the Association, said the measure was introduced as a means of protecting the safety of the public. No opposition developed at a recent hearing, and the committee has the matter under advisement.

A. C. Conference at Illinois

URBANA, ILL.—To answer questions in the mind of the layman concerning air conditioning, an Air Conditioning Conference will be held on the University of Illinois campus May 4-5. This is said to be the first such conference designed for the layman.

The Conference is sponsored by the University's College of Engineering. Heading the program will be the University's president, Dr. A. C. Willard.

Comfort conditions and physiological factors involved in air conditioning will be treated by F. C. Houghten, director of the ASHVE Research Laboratory. Prof. A. P. Kratz, of the University will discuss physical factors affecting comfort.



Breakdown of modernization work financed by FHA insured notes showing that heating and plumbing leads all other classifications in value of work done and run second only to machinery and equipment in number of loans insured. Chart by FHA's Division of Economics and Statistics.

Gas Rate Down

HARTFORD — Announcing a substantial reduction in rates, the Hartford Gas Company has launched a drive for house heating and air conditioning business. The present minimum rate of 5½ cents per hundred cubic feet for gas used above 50,000 cu. ft. drops to five cents per hundred for all above 10,000. The new rate was effective March 1. Heretofore house heating customers have been paying seven cents a hundred for consumption between 2,000 and 50,000 cu. ft.

Bassler Heads Chicago A.C. Group

CHICAGO—Following several preliminary gatherings, the newly formed Chicago Air Conditioning Association held a dinner-meeting and election of officers February 19. C. J. Bassler, Air Conditioning Corporation, elected president of the association, outlined the purposes of the new organization, which include the aim to stabilize the industry in Chicago, to eliminate certain practices in sales and engineering which are now irksome and enable firms connected with the industry to do good work at a reasonable profit.

Other officers elected were, W. A. Matheson, Williams Oil-O-Matic Heating Corporation, vice-president; Harry C. Yelton, Inland Supply Company, treasurer, and R. Hamlin Petty, secretary.

To insure representation to all branches of the industry, the board of directors will be made up of one representative from each of the following groups: manufacturers, wholesalers, steamfitters, sheet metal contractors, oil burning, gas burning, coal burning, refrigeration, and accessories. Additions may be made to the board, it was stated, should it later be found necessary. Directors will be appointed at an early meeting.

Membership in the association is divided into three classes. Active members are individuals or firms engaged in manufacture, distribution, sale or installation of air conditioning equipment, or in promoting use of air conditioning. Dealer members include individuals or firms acting as a sub-dealer for an active member. Associate members are individuals or firms engaged in the manufacture, sale or distribution of products related to air conditioning.

Carrier Holds Sales Meeting

NEWARK, N. J.—Carrier Engineering Corporation has just completed at its main offices and plant here the biggest and most successful sales convention of distributors, dealers, sales engineers and air conditioning technicians in the company's history. Total attendance was between 400 and 500. Sessions ended January 25 with a school for dealers in all phases of air conditioning and refrigerating engineering practice. These classes were preceded by a sales conference at which the company's new general manager, L. R. Boulware, was introduced by J. I. Lyle, president, and outlined broad sales policies for 1936.

E. C. Wampler, director and member of the Carrier Engineering Corporation's executive committee, outlined the national business picture. One of the features of the meeting was an address "Stabilizing the Air Conditioning Industry," by W. B. Henderson, executive vice-president of the Air Conditioning Manufacturers Association. M. E. Gillis of Commercial Investment Trust, Inc., spoke on "Financing Jobs." D. E. French, vice-president in charge of engineering, and V. S. Day, director of dealer contact engineering, explained new features and construction in the Carrier line for 1936.

Some of the officers and members of newly-formed Chicago Air Conditioning Association. Left to right: R. Hamlin Petty, secretary; J. H. Manney, Robinson Furnace Co.; W. J. O'Neil, Iron Fireman Co., C. J. Bassler, Air Conditioning Corp., president; W. A. Matheson, Williams Oil-O-Matic Heating Corp., vice-president.

COMING EVENTS

MARCH 25-27, 1936. *State Air Conditioning Conference, Iowa State College, Ames, Ia., under auspices of Mechanical Engineering Department and Engineering Extension Service.*

MARCH 31-APRIL 3, 1936. *Fourth Annual Short Course on Warm Air Heating and Cooling, Michigan State College, East Lansing, Mich. Cost—$2 registration fee. Communicate with Prof. L. G. Miller, Department of Mechanical Engineering of the College.*

APRIL 6-11, 1936. *Southern Industrial Show, Textile Hall, Greenville, S. Car.*

APRIL 14-18, 1936. *Twelfth National Oil Burner Show, Convention Hall, Detroit, Mich.*

APRIL 20-24, 1936. *Midwest Power Engineering Conference (Palmer House) and Engineering and Power Exposition (International Amphitheater), Chicago, Ill.*

APRIL 21-23, 1936. *Conference on Solid Fuels and Domestic Stokers, University of Wisconsin, Department of Mechanical Engineering, Madison, Wis. Communicate with Prof. L. A. Wilson, Mechanical Engineering Building of the University.*

MAY 25-27, 1936. *Forty-Seventh Annual Convention of Heating, Piping and Air Conditioning Contractors National Association, Bellevue-Stratford Hotel, Philadelphia, Pa.*

JUNE 9-11, 1936, *Short Course in Coal Utilization, Department of Mining and Metallurgical Engineering, University of Illinois, Urbana, Ill.*

JUNE 16-19, 1936. *National District Heating Association Convention and Exhibit, Pantlind Hotel, Grand Rapids, Mich.*

JUNE 17-18, 1936. *National Warm Air Heating and Air Conditioning Association Convention, Deshler-Wallick Hotel, Columbus, Ohio.*

JUNE 22-24, 1936. *Semi-Annual Meeting American Society of Heating and Ventilating Engineers and American Society of Refrigerating Engineers (Joint Meeting), Buck Hill Falls, Pa.*

Gas Water Heater Campaign On

NEW YORK—A portfolio of advertising literature available in a nationwide automatic gas water heater campaign has been prepared and distributed to gas companies and heating and plumbing dealers throughout the U. S. The campaign is sponsored by the American Gas Association, gas utilities, and gas water heater manufacturers. The portfolio is entitled "A Rousing Clean-Up Drive to Sell 300,000 Automatic Gas Water Heaters in 1936." The portfolio is 11 x 17 in., spirally bound.

Officers Appointed by Delco-Frigidaire

DAYTON—Delco-Frigidaire Conditioning Corp., Dayton, Ohio, whose formation was announced on these pages last month, has appointed, it is understood, the following officers:

President and general manager, E. G. Biechler, who has been president of Frigidaire Division for 11 years, and in which capacity he will continue; vice-president and assistant general manager, W. F. Armstrong, who has had and will continue to have the same title with Frigidaire Division; vice-president and general sales manager, J. J. Nance; vice-president, T. L. Lee, who has been, and will continue to be, vice-president of Delco Appliance Division.

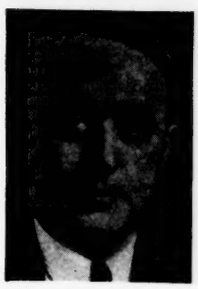
Both Frigidaire and Delco Appliance Corporations have been active for years in the design, manufacture, and sale of air conditioning equipment, Frigidaire concentrating upon the type of products necessary for cooling and dehumidification and Delco Appliance devoting its efforts toward supplying products for automatic heating, humidification and purification of air.

The new corporation has appointed Lord & Thomas to represent it as its advertising agency.

E. G. Biechler

W. F. Armstrong

J. J. Nance



T. L. Lee

James A. Trane

LA CROSSE, WIS.—James A. Trane, for many years a prominent manufacturer of heating specialties and vice-president of The Trane Company, died in Los Angeles January 24. He had been in ill health for a number of years and death was attributed to a weakened heart condition.

Mr. Trane was one of the pioneers in modern heating, beginning his career in a plumbing shop in 1886. In 1910 he was joined by his son, Reuben N., who is the present president of The Trane Company. Mr. Trane was 76 years of age.

Marked Progress in Equipment Design Displayed at Chicago Show

(Concluded from page 40)

Successful quieting of air conditioning ducts was emphasized in a display of recently developed air acoustic sheets by an insulation manufacturer. A new balsam wood duct insulation was another answer to the trend toward quiet operation. Another insulation display featuring animal hair composition showed the continuous effect of running water as a surface condition which would not impair the insulation.

The hot water heating section was unusually complete, featuring everything from modest devices to the most complete systems for providing hot water supply in all seasons and in any amount. Naturally related were the displays of circulating pumps, control valves, and the major heating and refrigerating accessories. Heaters using diesel fuel claimed a new low cost record for hot water for homes.

Manufacturers took the opportunity to introduce refinements in the design of new equipment and in the conversion of old. Unit heaters, unit coolers, and unit humidifiers benefited by this trend. One company exhibited a unit heater declared to be the first to have a decibel rating. Emphasis was devoted to showing that no matter what the construction of the residence or commercial building, a unit conditioner could be designed to fit it. In the design of the units themselves further attention was given to the principles of airflow. Large elliptical copper tubes were styled to offer the greatest possible heating surface in contact with the passing air.

A comprehensive series of displays under the section devoted to fans and blowers included centrifugal fans, schoolroom unit ventilators, high speed quiet fans, and multi-vane low speed fans. Some grilles evidenced the advances made toward concealment of duct, minimum resistance, minimum noise, dual control of air flow, and large free air capacity.

A special exhauster was offered for high temperature operation (1400°). Fans featured for their quietness emphasized installations in offices, restaurants, and theaters.

Air conditioning registers designed to resemble the trim appearance of Venetian blinds marked an interesting style trend. Related to the problem of ventilating was a new and ingenious device for the easy propelling of air around duct elbows, permitting the use of easily fabricated right angle turns throughout an entire system.

Displays of instruments and control equipment at the Exposition were remarkably complete. Broadly, these devices could be classified with respect to those which indicated or recorded the conditions of operation, and those which actuated it in a mechanical or automatic sense. The recording and indicating instruments provided for instant or continuous recording of temperature, humidity, air circulation, pollution, clarity, density, and other specific factors which underlie the scientific design and operation of all of the various devices which were on display. The tendency toward dynamic display was emphasized in one large exhibit which showed a complete model of a central station air conditioning system. Switches on the front of the display enabled the spectators to operate the equipment.

One exhibitor showed a series of compression couplings for piping. With these available it is necessary only to have a hack saw, pipe, and wrench to make a piping installation. Two pieces of pipe that are to be joined are brought together and the compression fitting is slipped over them. Nuts on both ends of the fitting are then tightened. Streamlined, solder-type fittings and seamless copper pipe came into their own. The streamline fitting invented and marketed during the depth of the depression is said to have grown in popularity since 1930 when its first month's sales were $4.31, until its present record of shipments at the rate of $10,000 worth per day.

Exhibitors of air valves, radiators and mains emphasized the balanced radiation principle using controlled venting. Splashproof motors in glass tanks continued to operate throughout the week of the Exposition though continuously splashed and sprayed with water from all directions. A glass model steam trap operating at 5 lb. pressure showed how the trap handled dirt and air, as well as condensate.

Metals, reflecting their close association and general importance in the heating, ventilating and air conditioning fields, were all present and were well displayed. Exhibits included those devoted to ingot iron ductwork, demonstrating difficult duct formations and construction. Valves were presented in terms of iron, bronze, and steel, and the sheet metal products included copper, tin, zinc, iron, steel, and a score of alloys. The large steel companies offered displays which were both fascinating and educational. These included a complete model of a blooming mill in operation, also a complete working model of a 79-in. hot continuous sheet mill, the original of which is a quarter of a mile long.

WITH THE MANUFACTURERS . . . . . .

Bell & Gossett Co., Chicago, has appointed **Bornquist, Inc.,** 629 West Washington Blvd., Chicago, as distributor for B & G products in that area. Local sales service and engineering which were formerly handled by the factory will be routed through the new distributing organization. Territory covered will extend from Gary, Ind., to Wisconsin and west to Joliet. The personnel of the new company is composed principally of men who have been associated with Bell & Gossett for a number of years and will include **B. H. Bornquist, A. E. Olander** and **P. P. Wolf.** Other members of the organization are **G. W. Bornquist,** formerly with Radiator Specialty Company, and **Frank Gall,** formerly with Steel Sales Company.

Combustioneer, Inc., Springfield, Ohio, formerly a subsidiary of **Steel Products Engineering Co.,** Springfield, Ohio, has been merged with the parent company, and is now known as **Combustioneer Division of Steel Products Engineering Company.** The merger will, it is said, have no effect on Combustioneer's personnel.

Delco-Frigidaire Conditioning Corp., Dayton, has established an eastern division general office and appointed **D. G. Spahr** as eastern division manager. The office will be located at 35 West 45 St., New York, and will have jurisdiction over Delco-Frigidaire activities in eastern states. Mr. Spahr formerly was sales manager for the Delco Appliance Corp., Rochester. He will have associated with him as assistant manager **L. W. Curl,** who has been assistant air conditioning sales manager for Frigidaire Corporation.

D. G. Spahr

Eagle-Picher Lead Co., Cincinnati, Ohio, and Joplin, Mo., has appointed **E. W. McMullen** director of research succeeding Dr. John A. Schaeffer, who has resigned to become president of Franklin and Marshall College. Mr. McMullen has been vice-president and plant manager of Ault & Wiborg Corporation.

Johns-Manville Corp., 22 East 40th St., New York, has appointed **George Dandrow** as manager of its New York district power products and industrial department. Mr. Dandrow joined the company in 1922 following his graduation from M.I.T., where he was intercollegiate hammer throwing champion.

King Ventilating Co., 545 West Washington Blvd., Chicago, announces that **Bernard J. Doyle,** Colby and Abbott Bldg., Milwaukee, will function as its exclusive distributor in the Milwaukee territory.

Modine Manufacturing Co., Racine, Wis., has appointed **Charles J. Gaskell** as its representative in Memphis, Tenn. Mr. Gaskell is a graduate of the University of Wisconsin engineering school. Seven years as plant engineer for the Bemis Cotton Mill, five years as superintendent of construction with Johns-Manville in St. Louis, and 12 years as a sales engineer in Memphis, have given him an excellent background in industrial heating. He will cover western Tennessee, northern Mississippi, and eastern Arkansas. His office is in the Falls Building, Memphis.

National Radiator Corp., Johnstown, Pa., has appointed **Norman R. Jones,** Rutledge, Pa., to serve as division manager to supervise the sales of the corporation's steel oil burning boiler-burner unit in New England. He will maintain offices at Somerville, Mass. **B. F. Werb,** Chicago, Ill., formerly connected with the Mercoid Corporation, has been appointed district sales manager for northern Illinois, Wisconsin, and southeastern Minnesota, with headquarters at Chicago.

Republic Steel Corp., Cleveland, Ohio, has appointed **Charles W. East** as district sales manager at Houston, Tex. Mr. East leaves his post as assistant manager of sales in the pipe division immediately to establish his headquarters in Houston. He succeeds **Robert E. Lanier,** resigned.

Republic Steel Corp., Cleveland, Ohio, has appointed **R. H. Sonneborn** as special sales representative of the tubular division. He will have headquarters in the Republic Building, Cleveland.

B. F. Sturtevant Co., Hyde Park, Boston, has promoted **Carl C. Gray** to the position of southern district manager, with headquarters in Atlanta. Mr. Gray has been in the company's employ for 15 years. He started as a salesman in the Chicago office, was later appointed advertising manager and at the time of his transfer to Atlanta was in charge of merchandising.

H. A. Thrush & Co., Peru, Ind., has appointed **M. M. Rivard,** Kansas City, as direct sales representative in charge of the territory of Kansas, Nebraska, and western Missouri, with headquarters in Kansas City. The company has also appointed **Walter A. Klein** as direct sales representative in southern Texas with headquarters in San Antonio.

The Timken Silent Automatic Co., of Detroit, has sold all its assets to the **Timken-Detroit Axle Company.** The change will not affect the status of the company's oil burner dealers, and the management will remain the same.

The Torrington Co., Torrington, Conn., and its subsidiary, **The Bantam Ball Bearing Co.,** South Bend, Ind., have appointed **A. S. Hellstrom** manager of the Cleveland, Youngstown, Akron, and Wheeling districts, with offices in the Caxton Building, Cleveland.

The Trane Co., La Crosse, Wis., is making an addition to one of its plants which will give an increase of 20,000 sq. ft. of floor space.

The Trane Co., La Crosse, Wis., has placed **Norbert D. Downey,** for many years advertising manager of the company, in charge of the unit heater and gas fired heater department sales and merchandising. Succeeding Mr. Downey as advertising manager is **L. A. Trumble** who rejoined the company organization two years ago after having previously been advertising manager for many years.

Yarnall-Waring Co., Philadelphia, has appointed **H. F. Heineman,** Wabash Building, Pittsburgh, to handle the sale of its products in western Pennsylvania and West Virginia. **Edgar D. Harder,** 2424 National Bank Building, Detroit, will assist in the sale of Yarway lines in the Ohio-Michigan district.

Owens-Illinois Holds Sales Meeting

TOLEDO—For the first time in the history of the Owens-Illinois Glass Company, the annual branch managers' meeting was this year converted into a meeting of all members of the company's sales staff January 23-25. Branch managers and salesmen from the company's 25 offices, together with all plant managers and assistants, over 250 men, met with officials of the company in the ballroom of the Commodore Perry Hotel and witnessed an elaborate presentation of the company's sales program.

To add zest and variety to the program, most of the divisions of Owens-Illinois had as part of their presentations skits in which messages and demonstrations of salesmanship were acted out for the branch managers and their salesmen.

Welding Firms Merge

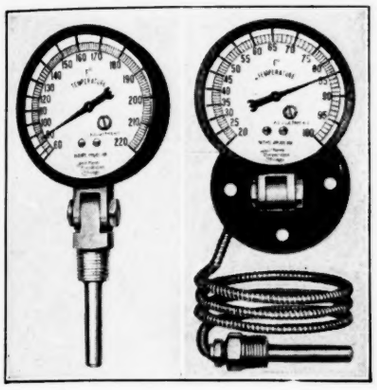
CLEVELAND—Two local welding firms were merged January 1 when Contract Welders, Inc., 4829 Lexington Avenue, acquired Industrial Welding & Cutting Co., 4400 Perkins Avenue. The two plants will be operated as divisions of Contract Welders, Inc., until April 1 when equipment and organization will be consolidated as Contract Welders, Inc., in large quarters at 2545 East 79th St., Cleveland.

NEW EQUIPMENT

Marsh Thermometers

NAME AND MODEL NUMBER—Universal socket dial thermometers, types 61 and 62.

FEATURES—Type 61 fitted with the Universal socket permits the use of the one instrument as a vertical connection thermometer, a 90° back angle thermometer, a front angle thermometer, or any intermediate angle. It eliminates the requirement of specifying a specific type of stem for each particular application. Type 62 distant reading thermometer is standard with 6 ft. of connecting tubing and a union bulb or, in the case of high temperature thermometers, either a union bulb or a flexible plain bulb. Has a mounting flange



Marsh thermometers, types 61 and 62

together with the universal socket which permits installation of instrument proper at any convenient point on top or in front of the apparatus or on a wall or pillar and then to install the bulb right at the point of temperature. Manufactured in 3½-in. dial size only and standard with black crystal finish all over, black crystal finish with nickel-plated trim, polished brass finish all over, or nickel-plated finish all over.

SIZES AND CAPACITIES—Complete assortment of Fahrenheit scale ranges for all requirements from 20° below zero up to 800° or corresponding Centigrade scales.

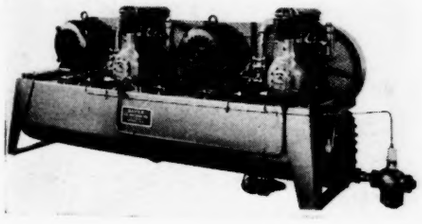
MADE BY—*Jas. P. Marsh Corp., Chicago.*

Baker Dual Condensing Unit

NAME—Baker dual condensing unit.

PURPOSE—For air conditioning.

FEATURES—Includes automatic capacity reduction so that unit can be operated at 40, 60, or 100% capacity on installations of 30 tons and less with a single condensing unit.



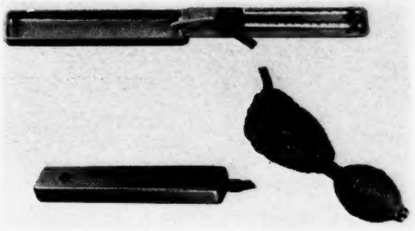
SIZES AND CAPACITIES—Three sizes, 20, 25, and 30 hp., using either two compressors with two independent motors or two compressors operating with one single motor, mounted in the center between the two compressors.

MADE BY—*Baker Ice Machine Co., Inc., Omaha, Neb.*

Friez Hand-Aspirated Psychrometer

NAME—Hand-aspirated psychrometer.

PURPOSE—For measuring relative humidity in cramped quarters or for locations where use



of a sling psychrometer is inconvenient or undesirable.

FEATURES—Wet and dry bulbs are aspirated by induced air which is drawn across the bulbs at a high velocity. The hand pump forces air through a venturi tube which draws secondary air from the outside across the wet and dry bulbs. The cover of the small chamber in which these bulbs are enclosed may be opened to facilitate applying water to the wet bulb, and also forms a thermo shield for the bulbs. The thermometers are secured to the hinged lid and the case of the instrument serves as a handle when in use. When not in use, the thermometers are protected inside the metal case.

DETAILS OF OPERATION—Use of instrument is simple, and satisfactory results can be obtained by a person unskilled in the art of using a sling psychrometer. The doubt as to whether a sling psychrometer has been whirled long enough or too long is eliminated. The operator operates the hand bulb pump and watches the thermometers until the correct condition is reached.

MADE BY—*Julien P. Friez & Sons, Inc., Baltimore, Md.*

Spencer Room Control

NAME—Remote thermostat for gas.

PURPOSE—Remote mechanical thermostat for room temperature control for gas heating equipment.

FEATURES—When used with room space heaters, the control can be mounted on the wall or on the heater itself; for central heating systems, the thermostat can be installed in any convenient place. The thermostat operates in conjunction with a diaphragm valve to which it is connected with a wall tubing. Available in standard rectangular shape with thermometer or in a circular shape without a thermometer.

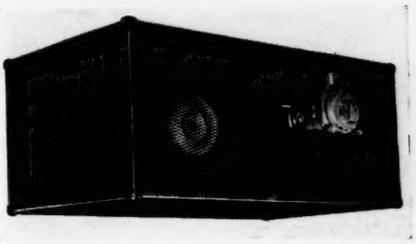
MADE BY—*Spencer Thermostat Co., Attleboro, Mass.*

Young Self-Contained Air Conditioning Unit

NAME—Young self-contained air conditioning unit.

PURPOSE—Circulating, heating, cooling, humidifying, dehumidifying, and cleaning.

FEATURES—Has continuous fan operation at all temperatures below 50° outside temperature. Above this the fan operates intermittently. As the temperature falls lower than 50° the cold walls of the room cause the air to stratify rapidly, and by the use of a tempering coil and continuous fan operation stratification is avoided in cold weather. Constant



fan operation is also recommended for summer operation.

MADE BY—*Young Radiator Co., Racine, Wis.*

Van System Air Conditioner

NAME—Van System air conditioning unit.

FEATURES—Unit depends entirely on washed air. Air is passed twice through a sheet of water produced through a whirling element. Gravity and momentum separates free water from the air. Humidistat controls amount of moisture added to air. Unit is designed to be connected to a warm air furnace type unit. Cools and dehumidifies in summer through evaporation and washing.

SIZES AND CAPACITIES—Air capacity 1,600 c.f.m. Humidifying capacity is 2 gal. per hr., ½-hp. motor. Dimensions of unit, 29x38x32 in. Finished in black crystal lacquer, and other colors.

MADE BY—*Railway Utility Co., Chicago.*

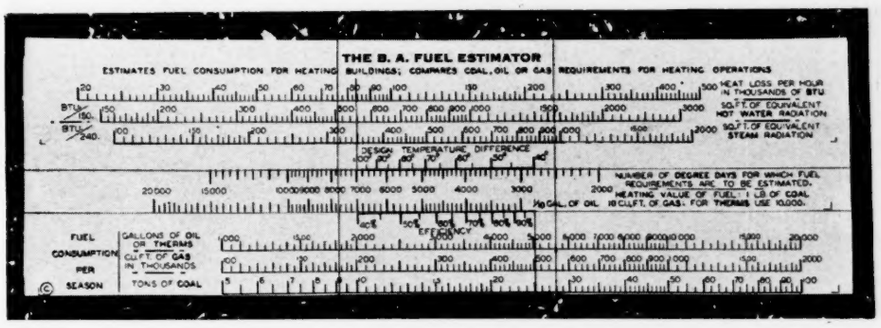
B. A. Fuel Estimator

NAME—B. A. Fuel Estimator.

PURPOSE—A slide rule combination for estimating fuel consumption for the heating of buildings regardless of fuel or location.

FEATURES—Takes into account variables such as heat loss, amount of standing radiator, number of degree-days, and heating value of various fuels.

MADE BY—*Calculator Specialties Co., Chicago.*


THE B. A. FUEL ESTIMATOR
ESTIMATES FUEL CONSUMPTION FOR HEATING BUILDINGS; COMPARES COAL, OIL OR GAS REQUIREMENTS FOR HEATING OPERATIONS
HEAT LOSS PER HOUR IN THOUSANDS OF BTU
SQ.FT. OF EQUIVALENT HOT WATER RADIATION
SQ.FT. OF EQUIVALENT STEAM RADIATION
DESIGN TEMPERATURE DIFFERENCE
NUMBER OF DEGREE DAYS FOR WHICH FUEL REQUIREMENTS ARE TO BE ESTIMATED.
HEATING VALUE OF FUEL: 1 LB. OF COAL
1 GAL. OF OIL 10 CU.FT. OF GAS. FOR THERMS USE 10,000.
EFFICIENCY
FUEL CONSUMPTION PER SEASON
GALLONS OF OIL OR THERMS
CU.FT. OF GAS IN THOUSANDS
TONS OF COAL

Lee Unit Type Heaters

NAME—Lee unit type air heater.

PURPOSE — For heating industrial buildings or for space heating. Especially designed for buildings where heat is required for only a short period each year.

FEATURES — Available for hand or stoker coal burning or for oil burning. Can be used to discharge air horizontally from the heater into a room or can be connected to a duct system. A third arrangement is to supply the heated air to the room from the base of the heater so as to keep the floor warm in such applications where material such as steel sheets may be stored on the floor and it is desired to prevent rusting.

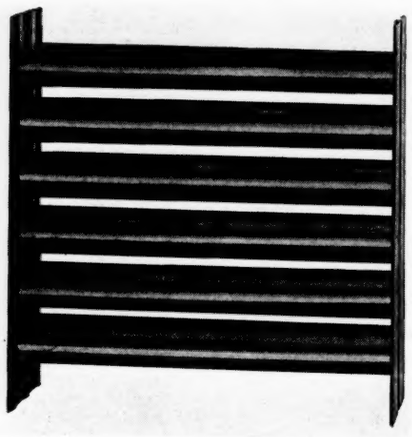
SIZES AND CAPACITIES—Available in two sizes with capacities of 300,000 and 700,000 B.t.u. per hr., in standard models. Also available in tubular type central type heater with capacities up to 7,00,000 B.t.u. per hr.

MADE BY—*Dravo-Doyle Co., Pittsburgh, Pa.*

Tuttle & Bailey Ducturns

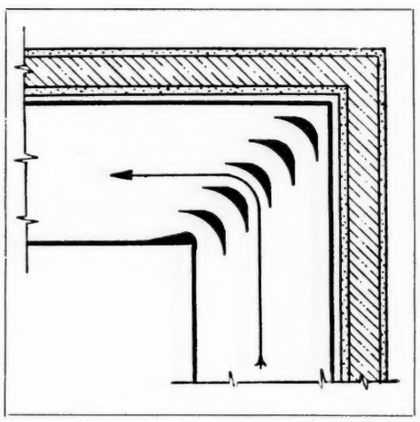
NAME—Ducturns.

PURPOSE—For insertion in right angle duct elbows to eliminate use of long radius elbows.



T & B Ducturns.

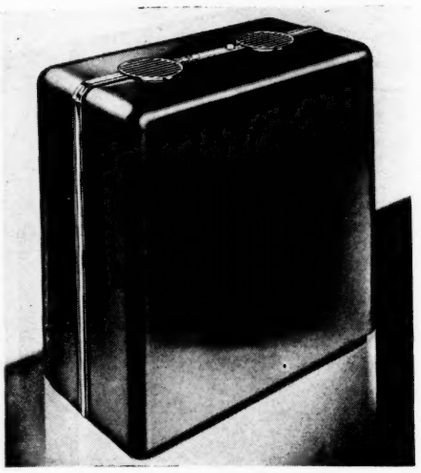
FEATURES — Consist of tubular blades so shaped that they are spaced at regular intervals. All points on the periphery of one blade are equidistant from similar points on an adjacent blade. Use of Ducturns avoids the loss of energy inherent in use of one piece splitters. Principal advantage is that all ductwork is made with right angle turns and can easily be concealed. In addition, the expense is lowered.



Section of elbow showing Ducturns.

SIZES AND CAPACITIES—Made into two types of blades in wide range of sizes.

MADE BY — *Tuttle & Bailey, Inc., New Britain, Conn.*



Nelson Summer Air Conditioner

NAME — Self-contained summer air conditioner.

PURPOSE—Cooling, circulating, and dehumidifying air for summer use.

SIZES AND CAPACITIES—Heat absorption capacity of 8,000 B.t.u. per hr. Air capacity 425 c.f.m. and dehumidification capacity 2.5 lb. per hr.

MADE BY — *The Herman Nelson Corp., Moline, Ill.*

Butler Stokers

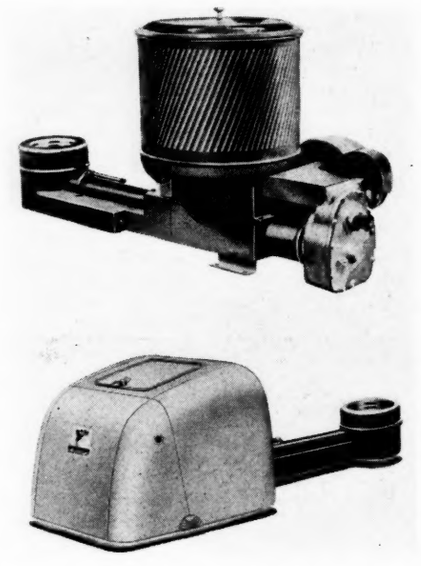
NAME AND MODEL NUMBER—Standard model No. 38 and Streamlined model No. 37 stokers.

PURPOSE—Domestic stokers.

FEATURES—Except for hopper and hopper base construction models are almost identical, having the same gear box, fuel and air ducts and retort base and interchangeable retort and tuyere combinations to provide tailor-made air distributions to fit the various coals found in each section. The Standard model has cylindrical hopper diagonally corrugated, while model 37 has a streamlined hopper. Features of both are their low price.

SIZES AND CAPACITIES—Model 38 is available in four capacities, sizes ranging from 18 to 50 lb. per hr. of fuel.

MADE BY—*Butler Manufacturing Co., Kansas City, Mo.*



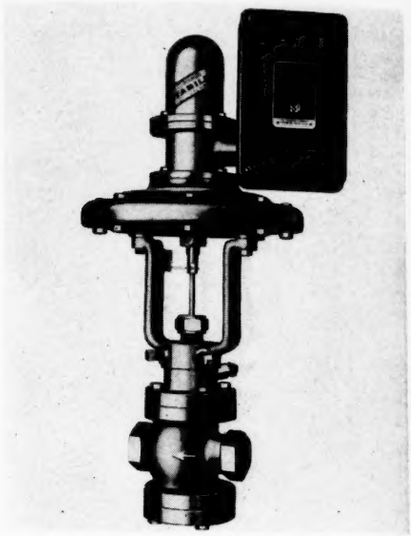
Upper view is the model 38 stoker, while below is the streamlined model 37.

Foxboro Valvactor

NAME—Vernier Valvactor.

PURPOSE—To enable small gradual adjustments of the control valve position on throttling type air operated control instruments.

FEATURES—Air from control instrument need change as little as ½ in. of water to cause a corrective positioning of valve and force stem to take a position within 1/1000 in. of previous setting, it is claimed. Mounted in cast aluminum case. Weatherproofed. Can be attached directly to the spring housing of



Vernier Valvactor mounted on a Stabilflo valve.

all sizes of Stabilflo valves. For needle valves it is mounted on side of motor supports.

MADE BY—*The Foxboro Co., Foxboro, Mass.*

Hubbard Conditioner

NAME—Air conditioning unit.

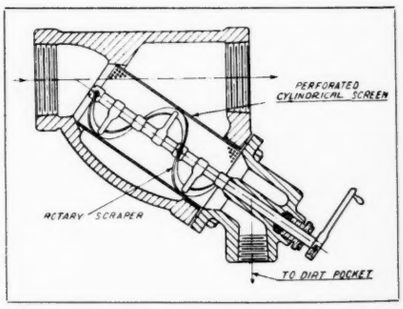
FEATURES—Combination economizer and conditioner. Uses waste heat from central heating plant. Filters, heats, humidifies, and washes air passed through the unit. Moisture introduced through water jet. Motor driven.

MADE BY—*The Hubbard Co., Minneapolis.*

Sarco Strainer

NAME—Pipe line strainer.

PURPOSE—For installation in pipe lines



ahead of pressure and temperature regulating and reducing valves, and for appliances likely to be damaged or worn by rust or scale.

FEATURES—Fitted with a plunger or rotary scraper within the cylindrical screen, enabling the screen to be cleaned without removal. Particularly suited for use where the flow is continuous and for this service it takes the place of more expensive duplex strainers.

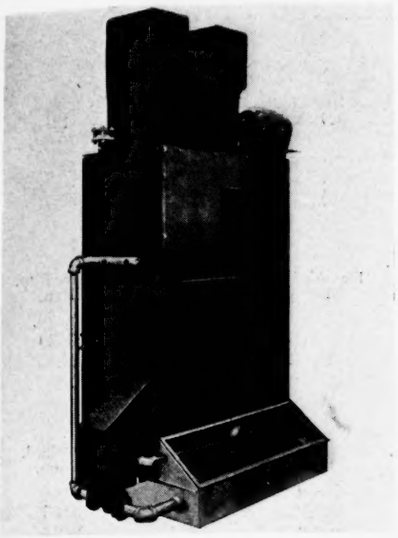
MADE BY—*Sarco Co., Inc., New York.*

York Economizer

NAME—York Economizer.

PURPOSE—Combination forced draft cooling tower and refrigerant condenser.

FEATURES—Arranged either for indoor or outdoor installation, being used indoors by providing ducts to bring in outside air and exhaust the heated, humidified air to the atmosphere.



DETAILS OF OPERATION — A fan passes the outside air through a bank of bare pipe coils over which water trickles in a direction opposite to the air flow, to give a Baudelot cooling action. Refrigerant is condensed inside the coils, and flows by gravity to the liquid receiver built in the base. Cooling water is recirculated from the drain pan by a pump driven by a fractional horsepower motor. The liquid receiver is made of seamless steel with a dished head, and is provided with a vortex eliminator to insure a minimum liquid level and maintain a liquid seal on the line.

SIZES AND CAPACITIES—Built in a number of standard models with capacities from 3 to 50 tons. Larger sizes are assembled to order in the field.

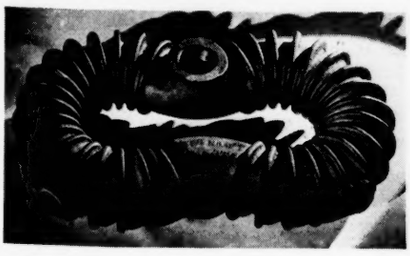
MADE BY—*York Ice Machinery Corp., York, Pa.*

Master Kraft Fuel Saver

NAME—Master Kraft Fuel Saver.

PURPOSE—For adding direct heating surface to round boilers.

FEATURES—Device as illustrated is a gray iron casting with ½-in. wall thickness finished on outside with rust preventive coating. Has no square corners or pockets to hold accumulation of mud, sludge, or insulating deposits.



It is connected into the firebox over the fire. Horizontal outlet is connected to return piping and vertical outlet to upper part of the boiler. Adds 6 sq. ft. of heating surface and consequently said to increase the boiler capacity approximately 100 sq. ft. of steam radiator.

MADE BY—*Harvey-Whipple Inc., Springfield, Mass.*

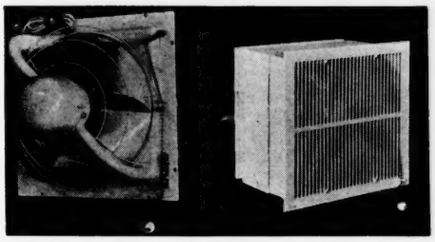
Ilgette's

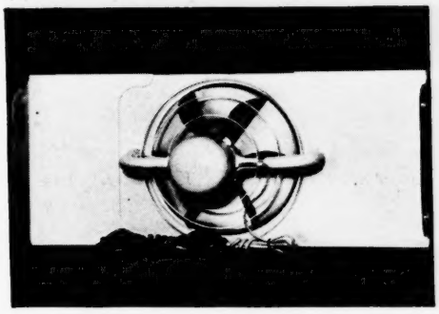
NAME—Ilgette.

Available in four types: the built-in-the-wall; portable window; built-in-the-window, and transom models.

PURPOSE—For kitchen ventilation.

FEATURES—Built-in-the-wall model is suitable for permanent installation. Unit includes fan, cabinet, and grille, the cabinet being fitted with a telescopic sleeve for use with different thickness walls. Started and stopped by nickel silver chain. Portable window type is suitable for use in all ordinary windows. Has adjustable panel and when placed in top of window does not interfere with the curtains, or with raising, lowering, or locking the window. Available in two adjustable panel sizes. Window built-in model is for building into the small panel windows now commonly used.





Upper left, built-in wall Ilgette; upper right, window built-in model; below, portable Ilgette.

Transom model is for use in small apartments and residence kitchens equipped with transoms.

SIZES AND CAPACITIES—1,550 r.p.m. Air capacity 400 c.f.m.

MADE BY—*Ilg Electric Ventilating Co., Chicago, Ill.*

Wrigraph Drafting Machine

NAME AND MODEL NUMBER—Wrigraph drafting machine, model E272.

FEATURES—Parallel mechanism is hand assembled with steel nickel-plated parts and solid phosphor bronze bearings. Completely equipped with a vernier indicating protractor reading to half degrees. L-Square Blade is made of pyroxylin and riveted to an aluminum stiffener.

SIZES AND CAPACITIES—20x26 in.

MADE BY—*L. G. Wright, Inc., 5713-28 Euclid Ave., Cleveland, Ohio.*

Nelson Furnace Unit

NAME—Air conditioning furnace unit.

FEATURES—Designed to provide winter air conditioning functions for comfort with optional cooling and dehumidification.

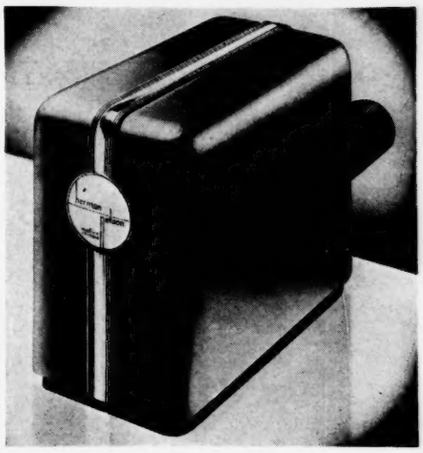
SIZES AND CAPACITIES—Capacity is 150,000 B.t.u. per hr. Burns No. 3 oil at 1.35 gal. per hr., and has an air capacity of from 1,500 to 2,000 c.f.m.

MADE BY — *The Herman Nelson Corp., Moline, Ill.*

Nelson Oil Burner

NAME—Conversion oil burner.

FEATURES—Of gun or pressure type, streamlined. Said to be unusually compact and efficient. Burns from 1.35 to 4 gal. of No. 3 oil per hr.. 1/6-hp. motor, 1,725 r.p.m.



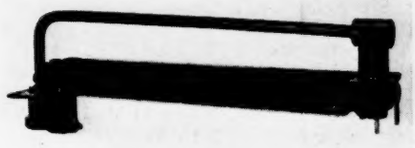
MADE BY — *The Herman Nelson Corp., Moline, Ill.*

Grinnell Thermofin Convector

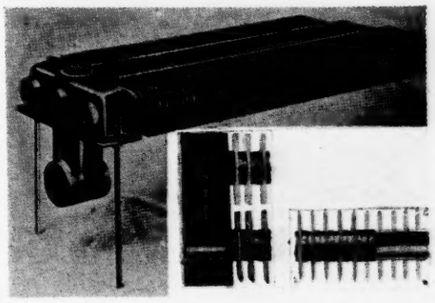
NAME—Thermofin convector.

PURPOSE—Concealed and cabinet type room heaters.

FEATURES—Available in two types, Simplex and Duplex, the former for single pipe steam heating, the latter for two pipe systems, either steam or water. The Simplex unit has a connection whereby steam travels up a loop to the free end of the convector where the steam enters the heater proper, so that the steam and water are always flowing in the same direction through the convector. The Duplex type has two headers of the drop-ell pattern which can be reversed for downfeed connections or arranged in other combinations to best suit the particular system.



Element of Simplex Thermofin for one-pipe steam system.



Element of Duplex Thermofin for two-pipe system.

SIZES AND CAPACITIES—Available in a wide range of widths, depths, and lengths in cabinets ranging from 18 to 30 in. wide.

MADE BY—*Grinnell, Inc., Providence, R. I.*

Degree-Days for January, 1936

Continuing HEATING & VENTILATING's eighth year of publishing degree-day data for various large cities in the United States

	Atlanta, Ga.	Baltimore, Md.	Birmingham, Ala.	Boston, Mass.	Buffalo, N. Y.	Burlington, Vt.	Chicago, Ill.
Degree-days for January, 1936	803	1059	724	1141	1297	1545	1426
Degree-days, Sept. 1, '35 to Jan. 31, '36	2111	2758	1919	3378	3866	4551	3865
Degree-days, Sept. 1, '34 to Jan. 31, '35	1782	2517	1518	3542	3626	4538	3374
Degree-days, Sept. 1 to Jan. 31, Normal	1813	2619	1502	3280	3611	4307	3487

	Cincinnati, Ohio	Cleveland, Ohio	Columbus, Ohio	Denver, Colo.	Des Moines, Iowa	Detroit, Mich.	Dodge City, Kan.
Degree-days for January, 1936	1236	1279	1280	1021	1668	1342	1136
Degree-days, Sept. 1, '35 to Jan. 31, '36	3362	3538	3499	3283	4313	3900	3139
Degree-days, Sept. 1, '34 to Jan. 31, '35	2725	3117	2948	2724	3663	3097	2565
Degree-days, Sept. 1 to Jan. 31, Normal	2795	3365	3133	3355	3762	3585	3068

	Duluth, Minn.	El Paso, Tex.	Evansville, Ind.	Fort Wayne, Ind.	Grand Rapids, Mich.	Harrisburg, Pa.	Hartford, Conn.
Degree-days for January, 1936	1934	604	1131	1405	1359	1223	1168
Degree-days, Sept. 1, '35 to Jan. 31, '36	5763	1629	2992	3921	3886	3256	3365
Degree-days, Sept. 1, '34 to Jan. 31, '35	5378	1320	2351	3393	3554	3031	3457
Degree-days, Sept. 1 to Jan. 31, Normal	5161	1667	2494	3414	3659	3069	3316

	Indianapolis, Ind.	Kansas City, Mo.	La Crosse, Wis.	Los Angeles, Calif.	Louisville, Ky.	Memphis, Tenn.	Milwaukee, Wis.
Degree-days for January, 1936	1327	1347	1718	176	1151	889	1515
Degree-days, Sept. 1, '35 to Jan. 31, '36	3595	3417	4682	518	3047	2326	4107
Degree-days, Sept. 1, '34 to Jan. 31, '35	2954	2802	4323	555	2418	1715	3782
Degree-days, Sept. 1 to Jan. 31, Normal	3130	3229	4313	750	2526	1871	3984

	Minneapolis, Minn.	Nashville, Tenn.	New Haven, Conn.	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma City, Okla.
Degree-days for January, 1936	1897	992	1141	343	1087	856	928
Degree-days, Sept. 1, '35 to Jan. 31, '36	5124	2589	3249	965	2970	2160	2517
Degree-days, Sept. 1, '34 to Jan. 31, '35	4613	1993	3258	667	2958	1926	1896
Degree-days, Sept. 1 to Jan. 31, Normal	4550	2175	3219	735	2910	1933	2244

	Omaha, Neb.	Peoria, Ill.	Philadelphia, Pa.	Pittsburgh, Pa.	Portland, Me.	Portland, Ore.	Providence, R. I.
Degree-days for January, 1936	1694	1419	1090	1315	1250	648	1139
Degree-days, Sept. 1, '35 to Jan. 31, '36	4274	3947	2858	3398	3834	2430	3329
Degree-days, Sept. 1, '34 to Jan. 31, '35	3419	3338	2675	2927	4056	2207	3421
Degree-days, Sept. 1 to Jan. 31, Normal	3639	3606	2734	3003	3817	2530	3245

	Reading, Pa.	Richmond, Va.	Rochester, N. Y.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Scranton, Pa.
Degree-days for January, 1936	1177	991	1290	1229	1069	345	1268
Degree-days, Sept. 1, '35 to Jan. 31, '36	3152	2580	3807	3229	3337	1316	3672
Degree-days, Sept. 1, '34 to Jan. 31, '35	2989	2337	3630	2555	2999	1217	3473
Degree-days, Sept. 1 to Jan. 31, Normal	3102	2231	3666	2798	3259	1414	3446

	Seattle, Wash.	Spokane, Wash.	Syracuse, N. Y.	Toledo, Ohio	Trenton, N. J.	Washington, D. C.	Wichita, Kan.
Degree-days for January, 1936	643	1028	1291	1369	1155	1061	1155
Degree-days, Sept. 1, '35 to Jan. 31, '36	2420	3688	3841	3845	3143	2798	3101
Degree-days, Sept. 1, '34 to Jan. 31, '35	2313	3368	3696	3388	3001	2583	2494
Degree-days, Sept. 1 to Jan. 31, Normal	2656	3755	3768	3390	2774	2711	2877

To obtain unit fuel consumption figures for any city shown above, multiply the number of degree-days by the following factors: for coal, 0.008; for oil, 0.00068; for gas, 0.096. Figures obtained will show coal consumption in pounds per square foot of radiator surface; oil consumption in gallons per square foot; gas consumption in cubic feet per square foot—all for the period covered by the number of degree-days. The figures assume the use of steam radiators emitting 240 B.t.u. per sq. ft. per hr., a system operation at 100% efficiency, and radiators calculated for maintaining 70° in zero weather. Heating values assumed for the fuels are 12,000 B.t.u. per lb. for coal; 140,000 B.t.u. per gal. for oil, and 1,000 B.t.u. per cu. ft. for gas. To correct for other heating values, efficiency and design conditions, follow the method explained in the "HEATING & VENTILATING Degree-day Handbook" or on H. & V.'s Reference Data Sheet Nos. 67 and 68. Degree-days as given above for "a normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.

EFFECTS ECONOMY IN STATE'S FUEL

Installation of Modern Equipment Saves $73,000 Annually

By Carter Wormeley

Richmond, Dec. 16—Under the direction of the supervisor of State power plants, Adolph Wagner, economies have been effected in the saving of fuel amounting to $73,000 per year, or over 37 per cent.

Believing that substantial reductions in fuel costs were possible, a survey of the heating plants of the State institutions was made in 1926 by Mr. Wagner, at the request of J. H. Bradford, director of the division of the budget. The survey disclosed that the plants were operated as efficiently as private plants of similar character, considering the available facilities. Some of the equipment used was obsolete and boiler settings too low, resulting in incomplete combustion and the loss of heat units. Furnace capacities were also inadequate for the burning of high volatile Virginia coal. Only low volatile Pocahontas and West Virginia coal was used.

Estimate Not Far Wrong.

Mr. Wagner estimated at that time a yearly saving of $80,000 by the replacement of obsolete equipment, proper furnace construction and changes in methods of firing.

Between 1927 and 1931 seven plants were improved, resulting in a yearly saving of $48,000.

Up to July 1, 1933, eleven institutional power plants have been improved, resulting in a yearly saving of $73,000.

In 1927 the total connected radiation in these institutions was 465,258 square feet. In July 1933 the connected radiation was 656,840 square feet, an increase of 29.1 per cent; yet, actually 2,253 tons less coal was consumed in 1932 than was consumed in 1927. Based on old methods of operation, over 15,000 tons of coal as saved, or over 29 per cent of the total tonnage used in these plants.

Soon Paid For.

Savings effected paid for the improvements in less than two years; in addition the plant capacities have been increased, resulting in better service. Boiler furnaces have been changed, so that Virginia mined coal can be used, and the installation of underfeed stokers made possible the burning of cheaper grades of coal and better operation is now had by the use of control instruments.

Approximately 73,000 tons of coal per year is used in the 27 State institutional heating plants. 3,600 tons of coal was consumed in the eleven plants covered by Mr. Wagner's report. The results accomplished indicate a substantial reduction possible in the total State fuel bill of approximately $300,000 when all plants will have been improved.

ROANOKE TIMES—DEC. 17, 1933

21 DETROIT STOKERS INSTALLED IN 8 VIRGINIA STATE INSTITUTIONS HELPED MAKE THIS SAVING

The $73,000 annual saving in the State of Virginia's coal bill that has resulted from Mr. Adolph Wagner's modernization of eleven institutional power plants points the way to possible economies for other states, municipalities and private business enterprises alike.

It is significant that Detroit Stokers are used exclusively in 8 of the 11 power plants modernized by Mr. Wagner.

Write for a copy of Bulletin 373, it tells why Detroit Stokers are frequently the most profitable investment in the power plant.

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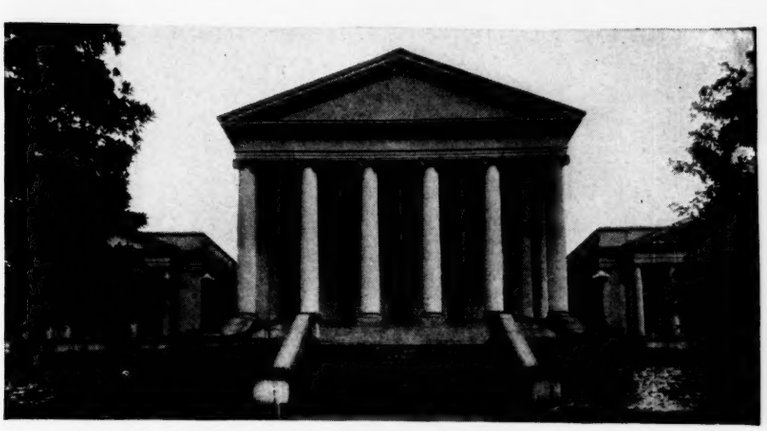


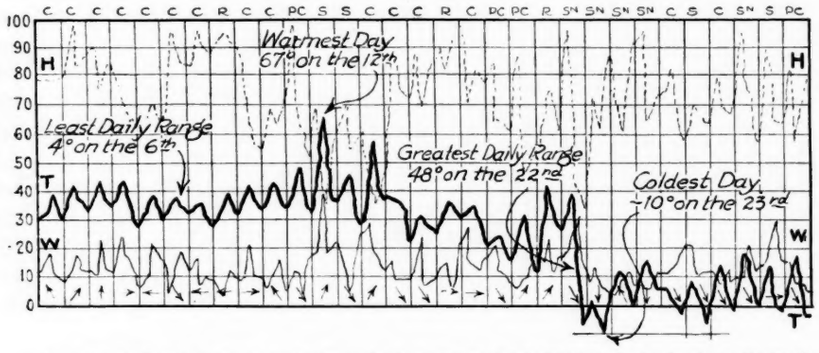
Virginia State Capitol, Richmond, Va.
(Two Detroit Stokers)

MODERNIZE AND ECONOMIZE WITH

DETROIT SINCE 1898 STOKERS

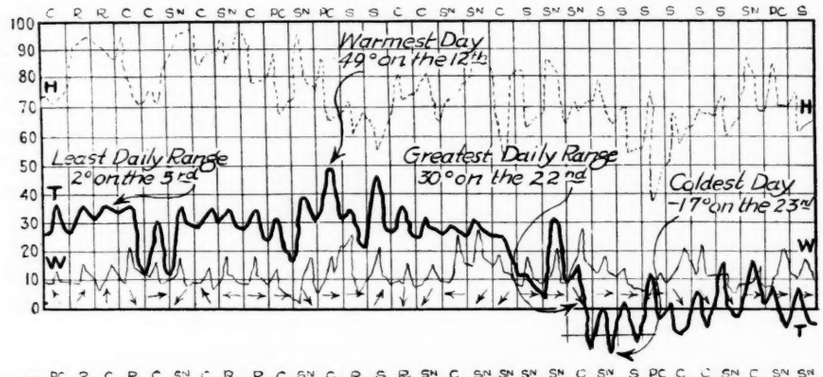
THE WEATHER FOR JANUARY, 1936

Plotted from records compiled for HEATING & VENTILATING by the U. S. Weather Bureau. Heavy curves (T), dry bulb temperatures in deg. F.; dotted lines (H), per cent relative humidity, from readings at 8 a.m., noon, and 8 p.m. Light lines (W), wind velocity in m.p.h. Arrows indicate prevailing wind directions, north being arrow pointing up, etc.; S—clear; PC—partly cloudy; C—Cloudy; R—rain; Sn—snow.



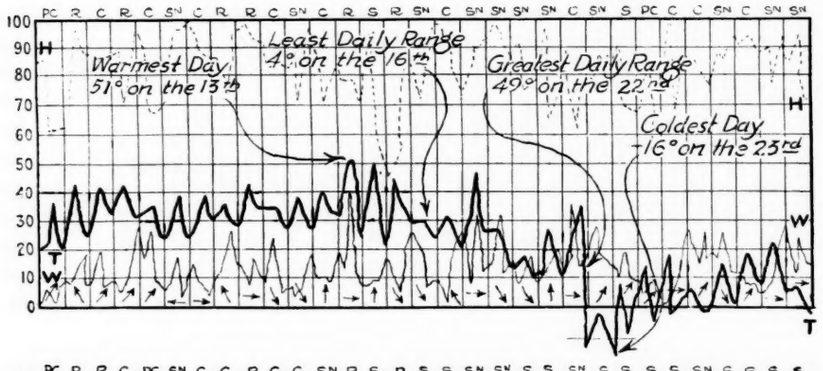
St. Louis

Mean temp. for month, 25.4°; aver. wind velocity 12.1 m.p.h.; prevailing direction of wind, NW.



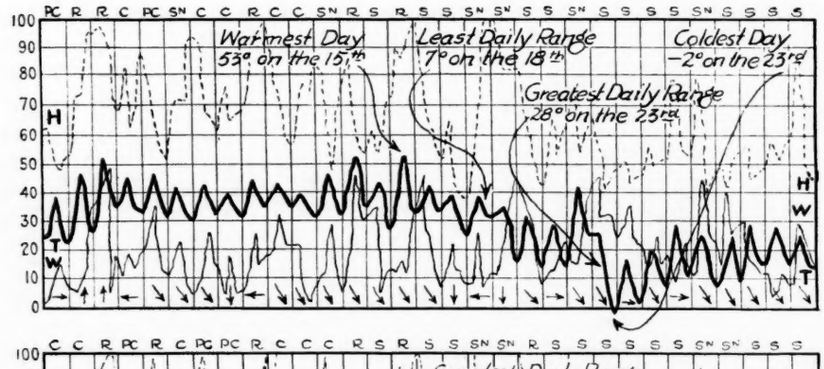
Chicago

Mean temp. for month, 19.0°; aver. wind velocity, 11.1 m.p.h.; prevailing direction of wind, W.



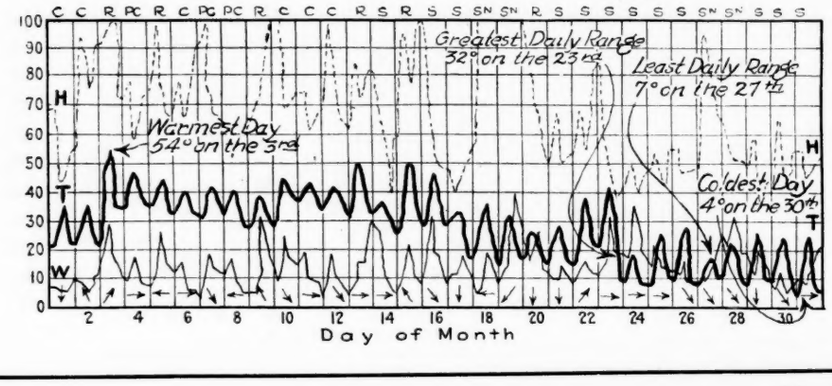
Pittsburgh

Mean temp. for month, 22.6°; aver. wind velocity, 11.9 m.p.h.; prevailing direction of wind, SW.



New York

Mean temp. for month, 29.9°; aver. wind velocity, 16.7 m.p.h.; prevailing direction of wind, NW.


Greatest Daily Range
32° on the 23rd
Least Daily Range
7° on the 27th
Warmest Day
54° on the 3rd
Coldest Day
4° on the 30th
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Boston

Mean temp. for month, 28.2°; aver. wind velocity, 12.6 m.p.h.; prevailing direction of wind, W.

-- Come --

The Power Event of 1936

Engineers, Manufacturing, Sales and Power Executives—everybody of importance in the industry will be there.

POWER SHOW AND CONFERENCE

CHICAGO — APRIL 20-24th

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Western Society of Engineers

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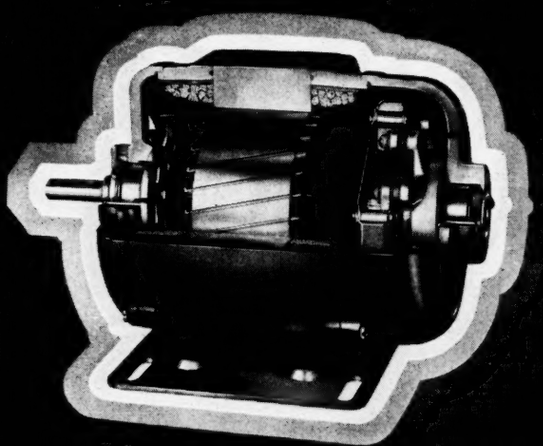

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BALDOR ELECTRIC COMPANY
4356 Duncan Ave., St. Louis, Mo.

BALDOR
A BETTER MOTOR

NEW CATALOGS

(Unless otherwise indicated the publishers of catalogs will supply copies on request without charge.)

Air Reduction Sales Co., 60 East 42 St., New York. A 32-page, standard size booklet relating to the company's electric welding products—electrodes, arc welding machines, and miscellaneous apparatus. The first section of the book is devoted to electrodes, while the second part relates to miscellaneous apparatus. The third part takes up the subject of Wilson arc welding machines, and the last section consists of tables useful to the welder.

Alfol Insulation Co., Inc., Chrysler Building, New York, has published a 2-page bulletin describing Alfol aluminum insulation. The company offers to install free for 10 days an Alfol radiator reflector behind a radiator in a room to show how radiant heat is reflected out into the room, and now it will conserve heat otherwise lost.

Bethlehem Steel Co., Bethlehem, Pa., has published two calculators, Nos. 47 and 48. Both are slide rule arrangements in which data relating to the company's steel sheets appear in openings in the outside covering when the inner slide is moved. No. 47 gives the weights per sheet, per bundle, and number of sheets per bundle, together with the widths and lengths of the various size sheets in different gages of the company's galvanized steel sheets. In addition, there is a table giving the weight per square foot of the different gage sheets. No. 48 gives the number of square feet in the different size sheets of corrugated roofing.

Century Engineering Corp., Cedar Rapids, Ia., has published an Iso B.t.u. Heat Loss Chart, which is a map of the U. S., with contour lines running over the map. Depending on the contour line passing through a given location the amount of radiator surface in either steam or hot water can be found by multiplying the glass, wall, and floor area of the building to be calculated by the factors given for that particular contour line, then adding. To estimate approximate oil consumption per heating season, when knowing actual heating load, divide B.t.u. requirement by 60, or multiply actual standing steam radiation by 4, or multiply actual standing hot water radiation by 2½. These factors are based on normal seasons, average conditions and correctly designed and applied equipment. The chart is printed on very heavy paper designed for wall mounting. Size 17½ x 24 in.

The Emerson Electric Mfg. Co., St. Louis, Mo., has published catalog X1149 entitled "Emerson Fans for 1936," devoted to the company's line of desk fans, circulating fans, ceiling fans, and exhaust fans. Standard size, 25 pages.

Frick Co., Waynesboro, Pa., has published bulletin 508-A devoted to its line of Freon compressors. Profusely illustrated with photographs of installations, photographs of the component parts, and cut-away drawing of a typical unit, together with dimensional data on the various models of the line. Bound in heavy paper and printed in color. Standard size, 16 pages.

Gorton Heating Corp., Cranford, N. J., is distributing an aluminum plate 3¾ in. long and 1½ in. wide containing holes showing the actual size of the air outlets of the company's equalizing valve and air eliminators. Along one edge is a 3-in. rule in thirty-seconds of an inch.

Hart & Cooley Mfg. Co., 61 West Kinzie St., Chicago, has published a 36-page catalog entitled "Air Conditioning Registers and Grilles." It contains much technical information of value to the air conditioning engineer. A section is devoted to the problem of air distribution, and charts and forms are included which make it a simple matter to select a grille of the proper type and size. Installation and construction details of the company's line of air conditioning registers, grilles, and intakes are given. Standard size.

Lamneck Products Inc., 416 Dublin Ave., Columbus, Ohio, has published the Lamneck Simplified Guide Chart, covering standard stock sizes in forced air fittings and ductwork. It contains numerous sketches and detailed tables covering the size, area, and list price of each of the extensive line of both round and rectangular fittings for ductwork. It is so arranged that it can be referred to without turning over, being on 5 x 10½ in. pages, folded.

Leeds & Northrup Co., 4902 Stenton Ave., Philadelphia, Pa., has published a 16-page, standard size catalog No. N-93 devoted to the company's Micromax smoke density recorders. The recorder can automatically measure smoke density at the stack, indicates and records it wherever needed, and signals major changes if desired. The catalog includes numerous photographs, line drawings, and dimensional data relating to these devices.

The Mercoid Corp., 4201 Belmont Ave., Chicago, has published a catalog 100 entitled "Automatic Controls for Heating, Air Conditioning, Refrigeration and Various Industrial Applications." Standard size 24-page bulletin with the pages laid out in a uniform manner showing the illustration, description, purpose, range, finish, types, and list price of the various controls in the company's line.

The Herman Nelson Corp., Moline, Ill., issued recently a six-page folder announcing a new line of automatic heat and air conditioning equipment with illustrations of its oil burning air conditioning furnace unit, conversion oil burner, and self-contained summer air conditioning unit.

John J. Nesbitt, Inc., Holmesburg, Philadelphia, Pa., has published an especially elaborate catalog of Nesbitt heating surface. The catalog is bound in a gold cover finished in red, blue, and black, and contains photographs and descriptive material relating to the heating surface, together with colored illustrations and blueprints showing a comparison of the heating surfaces. Blueprints showing typical applications are included. The second part of the booklet is devoted to engineering applications and gives physical data relating to the product, and instructions for selection, including examples. The tables of capacities are printed in two colors and are easy to follow. Standard size, 40 pages.

Republic Steel Corp., Central Alloy District, Massillon, Ohio, has published an 8-page folder entitled "Here's a Double-Edged Sword to Help You Cut Air Conditioning Costs," describing and illustrating the use of Toncan iron pipe and fittings in connection with air conditioning equipment.

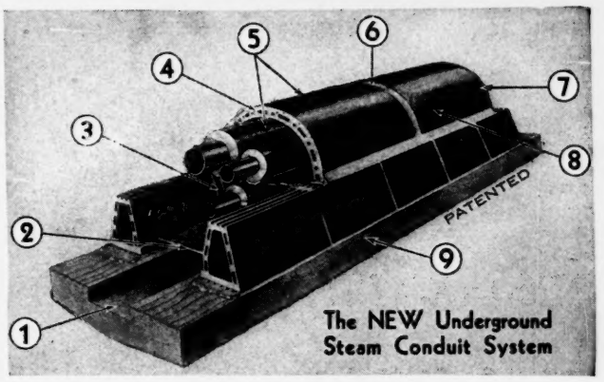
H. A. Thrush & Co., Peru, Ind. A sales and engineering manual. Standard size, 12-page bulletin which includes the company's tank and basement equipment, pressure systems with special information for gravity circulating installations and also forced circulating installations without summer-winter control. Products are completely described and illustrated. Includes engineering data on hot water heating.

Wagner Electric Corp., St. Louis, has prepared Bulletin SD549 on "Service Instructions for Capacitor-Start Induction-Run Motors" for use of manufacturers of motor-driven appliances and their service organizations. The bulletin lists the troubles most frequently encountered. The subject has been prepared in outline form in order to make it a simple matter to spot the type of problem encountered and obtain the solution.

Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo. Bulletin 178, a standard-size loose-leaf catalog entitled "Wagner Fans" devoted to descriptions, illustrations, dimensional and capacity data on the company's desk, ventilating, exhaust and other type propeller and disc fans. 16 pages.

The Youngstown Sheet and Tube Co., Youngstown, Ohio, has published a booklet giving a complete description of modern continuous mill operation, explaining by means of photographs and easily read descriptive material the company's new continuous process for making sheet and strip steel. Standard size, 12 pages.

THERM-O-TILE

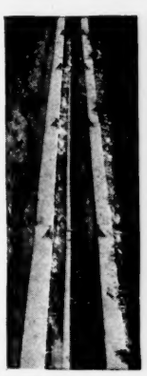


In our latest bulletin you will find facts on the above indicated details, 1 to 9 inclusive. Below we show

THREE SUCCESSIVE STEPS

in Therm-O-Tile construction. Note particularly that the piping and hollow tile conduit are *independently supported on the concrete base.*

Concrete foundation slab with internal drain channel. Pipe supports in place.



Piping on roller supports, accessible for welding and insulation.

Conduit envelope supported on slab. All joints water tight. Ready for back fill.

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Permanent Heating Comfort Assured this Washington, D. C. Library by—

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Illustration shows the Georgetown Branch Library, Washington, D.C., which is equipped with a Sarco Vapor Heating System with boiler return trap and a Sarco Temperature Regulator on the water heater.

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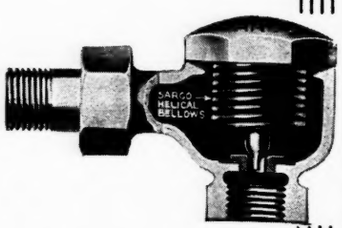

Fine materials and facilities alone could not maintain Sarco's reputation as manufacturers of dependable heating systems. The experience which Sarco has gathered together and fostered in its men for nearly a quarter of a century is still more important. For it would be hard to duplicate their engineering knowledge and experience.

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ABSTRACTS

(Continued from page 62)

Heating by Income Classes in San Diego

Gas is used for house heating by approximately 45% of all families in San Diego, and by more than half of those families who are tenants. Next in importance is wood which is used by more than one-third of the family population. Slightly less than 11% burn kerosene, presumably in stoves.

In the same city the stove is the most commonly used equipment for house heating by families within all income groups. Central heating plants are installed in only about 4% of the homes with warm air and steam about equally represented.

This information is given in the latest of the series of "Consumer Use of Selected Goods and Services, by Income Classes" published by the Department of Commerce. Market Research Series No. 5.7. Published by the Bureau of Foreign and Domestic Commerce.

[*"Consumer Use of Selected Goods and Services, by Income Classes, San Diego, California," by Ada Lillian Bush. Mimeographed, 33 pages, 8½ x 11, bound in heavy paper. The seventh in a series, previous issues of which covered Austin, Fargo, Portland, Me., Columbia, Salt Lake City, and Trenton. Price, 10 cents.*]

●

Panel Radiators for High Temperatures

In radiant heating installations it is sometimes desired to use panels having a plaster finish, but when a building is heated partly by ordinary radiators, the hot water available is generally at about 160° and would consequently damage plaster panel facings. In these circumstances, panels especially designed to withstand water at this temperature may be used. Three of the four tested in this series were of this type and the first of these, designated as G, was a special panel the construction of which was suggested by H. M. Office of Works.

This special plaster panel was made of a grid of ¾-in. pipes at 6-in. centers carried by ¼-in. transverse rods in a shallow wooden frame measuring 4 x 2 ft. Expanded metal, wired to the rods and pipes, was fixed across the frame and supported the ¾-in. plaster face of the panel. The pipe grid was covered with sand poured into the frame to a depth of 2 in. Two sheets of ½-in. wall board were fixed across the upper side of the frame leaving a 1-in. air space above the sand. A 2-in. layer of slag wool laid on the wall board completed the insulation.

The two other plaster faced panels, suitable for use with water at a high temperature, were of a type which are commercially available. Each comprised of a slab of concrete, 4 x 2 ft. x 5 in. thick, in the lower surface of which was embedded a pipe grid covered with asbestos insulating sleeving. Panel H contained a grid of ¾-in. pipes and panel I one of ½-in. pipes. The lower surface of each panel was finished with 1-in. wooden flooring.

For the purpose of comparison a fourth panel, J, of normal construction was tested. This comprised a similar block of concrete with an uninsulated ¾-in. pipe grid cast into the lower surface, which was subsequently plastered. The upper surface was covered with 1-in. wooden flooring as in the case of the two preceding panels. The tests on this panel were made with water at 120°.

The pipe grids used in all four panels described were all of the same shape. In the case of every panel a number of measurements were made as the panel warmed up and from the figures obtained, the ultimate rate of emission of heat by radiator was obtained. This is given in the table together with brief descriptions of the various panels. The heat emissions are for radiant heat only since in the still air of the box there can be little or no transmission of heat vertically downwards by convection. A column is included giving the approximate heat leakage upwards to a cover panel maintained at 60°.

Panel	Description.	Flow water temp. °F.	Measured radiation received on 4 ft. by 2 ft. plate at 60° F. B.T.U./sq. ft./hr.	Heat leakage upwards. B.T.U./ sq. ft./hr.
G	Special plaster panel with ¾ in. pipe grid	160	48	9
H	5 in. concrete panel with ¾ in. pipe grid insulated with sleeving	160	46	26
I	Similar to H but with ½ in. pipe grid insulated with sleeving	160	46	(25)
J	Similar to H but with ¾ in. pipe grid without insulation ..	120	40	25

It was anticipated that there would be about 4% difference between panels H and I due to the difference in the pipe sizes. Actually these panels were found to be identical, but no special significance is attached to this as only one panel of each type was tested. The figures quoted in the table indicate the magnitude of the radiant emissions.

[*"The Testing of Panel Radiators," by W. G. Marley. Published in the Journal of the Institution of Heating and Ventilating Engineers, London, page 350, October, 1935.*]

●

Mechanical and Electrical Equipment of Buildings

There is a gap existing in the available literature on the mechanical and electrical equipment of buildings between the simplified explanations prepared for the manual workers in the industry and the technical treatises for the engineer. The lack of this semi-technical literature has made it difficult for men not directly connected with this industry to readily obtain a knowledge of the subject. According to the authors of this book, this lack of information has been felt particularly by practicing architects and by the students of mechanical and electrical design in architectural and technical schools.

It is the purpose of this book to fill this gap. The book makes no pretense of being a handbook of engineering design but is rather a textbook for acquainting its readers with the basic principles of the subject.

The book is divided into five sections—each division covering one class of equipment. The five sections are entitled water supply, plumbing and drainage, heating and air conditioning, electrical equipment, and acoustics.

Approximately 100 pages are devoted to the subjects of heating and air conditioning. In this section are presented brief semi-technical explanations of heat and heat loss, warm air heating, steam heating, hot water heating, radiators, piping and boilers, air conditioning—theory and design, and air conditioning—application and equipment.

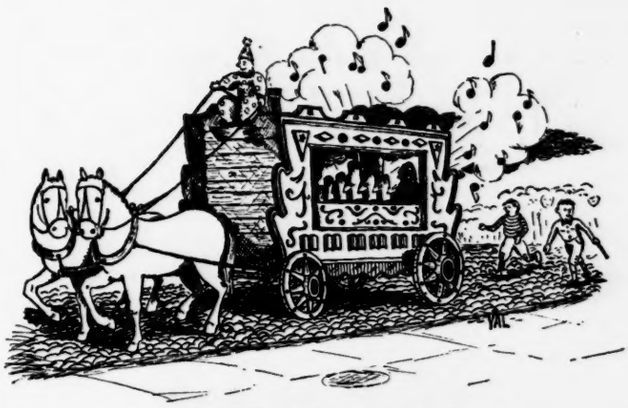
Heating engineers and contractors will find this book of considerable value in acquainting them with the features of the other types of equipment installed in buildings. Building managers and owners will also find this book a help to them in the selection and maintenance of the electrical and mechanical equipment in their buildings.

[*"Mechanical and Electrical Equipment for Buildings," by C. M. Gay and C. Fawcett. Published by John Wiley & Sons, Inc., New York. Cloth-bound; 6 x 9 in.; 429 pages; price $5.*]

●

SILICOSIS ABSTRACTS. The second book of a series on the literature and laws relating to silicosis. Abstracts, articles, papers, comments and discussions appearing in United States and foreign countries during 1934.

[*"Review of the Pneumonokonioses—Literature and Laws of 1934," compiled by Davis, Salmonsen and Earlywine. Published by Chicago Medical Press, 302 South Canal St., Chicago, Ill. Cloth-bound 6 x 9 in.; 490 pages; price $7.50.*]



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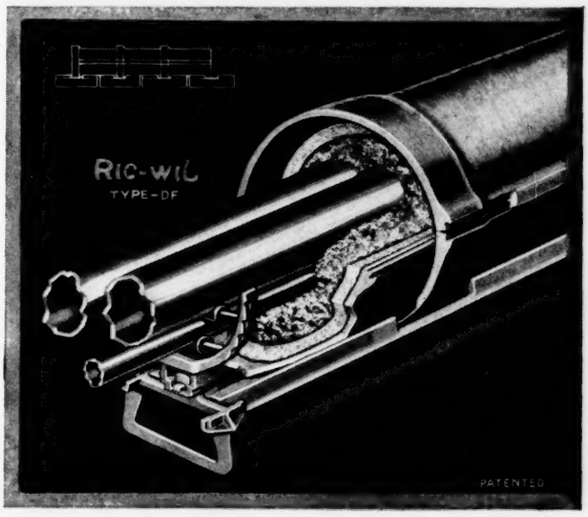

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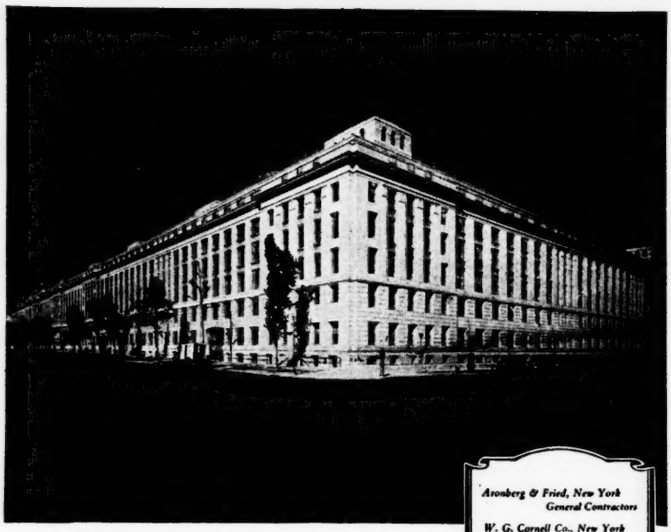

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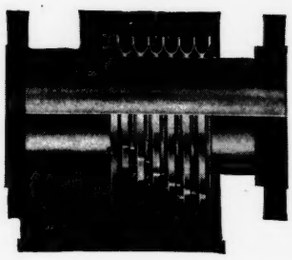

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Write for Bulletin No. 35-50 which illustrates and describes this new expansion joint.

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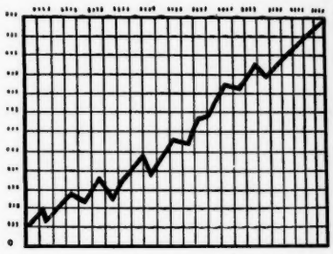

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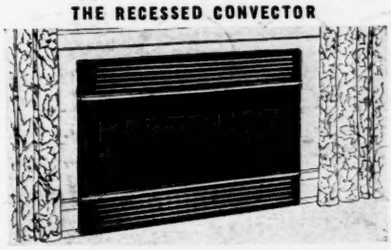

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